VOL. 29 NO. 5

BULLETIN

OF THE

TORREY BOTANICAL CLUB

MAY 1902

The Nidulariaceae of North America*

BY V. S. WHITE

(WITH PLATES 14-18)

The members of the family Nidulariaceae are small fungi, seldom attaining a height of 15 mm., the average height being from 5–7 mm. The ripe sporophores are usually more or less regularly cup-shaped, containing from 10–20, or in some species, more, lenticular seed-like bodies, which are analogous to the chambers of the gleba in the other chief groups of the gastromycetes; these bodies are usually known as sporangioles or peridiola, while the cup is known as the peridium.

They are widely distributed, as will be shown in the following pages, and several of the species are fairly common, appearing principally in wet weather, in late summer and autumn, often per-

*This revision of the family was made possible by the large amount of material found at the New York Botanical Garden, principally forming part of the Ellis collection, and by additional material furnished by Professor L. M. Underwood, from his own private collection. Professor F. S. Earle and Professor C. H. Peck also kindly loaned specimens. Thanks are due to Professor G. F. Atkinson, of Cornell University, for the loan of three drawings of *Nidularia Alabamensis* made by Mr. H. Hasselbring, and for a specimen of this same species; to Professor Farlow, of Harvard University, for kindly allowing specimens of *Cyathus pallidus* Berk. & Curt. and *Cyathus Wrightii* Berk., to be examined and sketched; to Mr. Stewardson Brown, of the Philadelphia Academy of Science, for his courtesy in facilitating the examination of Schweinitz's specimens nos. 2211–2220; to Miss Anna Murray Vail, Librarian of the New York Botanical Garden, for help in tracing references; to Mr. E. S. Salmon, for looking up some data at Kew, England, and most especially to Professor L. M. Underwood, under whose direction the work was undertaken.

sisting through the winter months. They grow on manure, sticks, shavings, dried herbaceous plants, and *Crucibulum crucibuliforme* is frequently found on old pieces of sacking. On a certain old board walk at Lakewood, N. J., this last species was found by the hundred growing in regular series between the joints of the boards. A further study of the plants will probably show that they are far more common and widely distributed than is at present thought, for they are likely to escape detection owing to their small size and inconspicuous coloring,.

The order Nidulariales comprises but one family, the Nidulariaceae. Until quite recently this family was considered by De Toni * and others to include the genera *Cyathus*, *Crucibulum*, *Nidularia*, *Thelebolus*, *Dacryobolus*, *Sphaerobolus*, *Polyangium* and *Atractobolus*, the last two included as doubtful genera. Fries † included besides the three first mentioned genera, *Arachnion* Schwein. *Myriococcum* Fries, and *Polyangium* Link. The two latter genera are certainly out of place here, *Myriococcum* belonging under the Perisporiales,‡ and *Polyangium* is not mentioned by either Saccardo or Fischer. In Fischer's revision of the family in 1899, he places *Arachnion* Schwein.§ under "Doubtful Genera" in the Sclerodermataceae; for *Sphaerobolus* Tode he establishes a separate family; *Thelebolus* is placed under the Ascobolaceae, and *Dacryobolus* and *Atractobolus* are included in the same family but as doubtful genera.

This leaves only the three genera, *Cyathus* (for which there is an earlier form of the name, *Cyathia*) *Crucibulum*, and *Nidularia*, in this family. Concerning the last genus a question already raised by Otto Kuntze presents itself in regard to the correct name, since Roth's *Granularia* ‖ antedates Fries and Nordholm's *Nidularia* ¶ by over a quarter of a century. Roth's description and figure of *Granularia pisiformis* place this genus on a certain footing, and there can be no hesitation in answering the above question. Recently some

* Saccardo, Syll. Fung. 7: 28. 1887.
† Syst. Myc. 2: 296. 1822.
‡ Saccardo, Syll. Fung. 1: 29. 1882.
§ Engler & Prantl, Nat. Pflanzenfam. 1^{1**}: 339. 1899.
‖ Ust. Ann. Bot. 1: 6. *pl. 1. f. 1.* 1791.
¶ Syn. Gast. 2. 1817–18.

plants resembling *Crucibulum* in habit * have been described under *Nidularia* which differ so much in the peridial structure and character from the type of the genus, with the exception of not having the sporangioles attached to the inner wall of the peridium, that it seems best to establish another genus in order to simplify as much as possible the arrangement of the family. It was ardently desired to retain the name *Nidularia*, but unfortunately it has been found impossible to do this as all seven of the species which Fries † gives under his section *Nidularia* conform to the type of *Granularia*, so the name *Nidularia* must pass into synonymy.

It is interesting to note that Corda ‡ included only *Nidularia* and *Cyathus* under the Nidulariaceae. Nees noted a resemblance between this family and *Polysaccum*, but the latter genus is included by Fischer § under the Sclerodermataceae as *Pisolithus* Alb. & Schwein.

Although the members of this family have been mentioned in nearly all works treating of fungi from the time of Clusius, 1601, little was known of their structure and life habits until 1842, when Schmitz || wrote a short paper on *Cyathus*, and two years later the brothers Tulasne,¶ instigated by this first effort to continue the study of these interesting plants, prepared their treatise on the organization and fructification of the Nidulariaceae, which, with the supplementary work of Sachs,** Eidam †† and Brefeld,‡‡ forms the foundation of our exact knowledge of this group of fungi.

The American species have never been monographed, and even the mention of plants belonging to this family has been comparatively infrequent.

* Under *Crucibulum* De Bary (Comp. Morph. 321) calls attention to the fact that he was unable to find a funiculus in some peridioles but says "the coil always showed a small point which answers to it." In the specimens referred to this genus there was absolutely no trace or rudiment and it would be impossible even in young sporangioles to determine to which side they had been attached.

† Anleit. 103. 1842.

‡ Syst. Myc. 2 : 300. 1823.

§ *L. c.* 338.

|| Ueber Cyathus. Linnaea, 16: 141. *pl.* 6, 7. 1842.

¶ Ann. Sci. Nat. III. 1 : 41–107. *pl.* 1844.

** Bot. Zeitung, 833–845, 849–861. 1855.

†† Cohn's Beitr. z. Biol. 2 : 221–245. 1876.

‡‡ Bot. Mitt. über Schimmelpilze, 3 : 176–180. 1877.

For a long time the Nidulariaceae seemed to be a bone of contention among various botanical writers, in the fact of their apparently differing from other fungi in having true and visible seeds.* In 1688 Camerarius published a dissertation "de Fungo calyciformi seminifero," setting forth his ideas on the subject and claiming that these fungi had seeds. Marsigli in 1713, on the contrary, tried to exclude what he calls "these simple plants" from the fungi, no fungi having true seeds as these plants seemed to have. In 1714 Tournefort was also inclined to exclude them from the fungi, but Ant. de Jussieu in 1728, denied these propositions, and claimed emphatically that fungi have seeds like true plants. Forty years later fungi were still being classed outside of the vegetable kingdom, particularly so because the sporangioles of *Cyathus* were never seen to germinate. Necker in 1783 wanted to make an intermediate kingdom to consist of the fungi, and Pico five years later, said that he had absolutely proved that the nature of these productions was purely animal. In 1791, Bulliard incontestibly proved that all fungi have seed, but he called the sporangioles of *Cyathus* seeds, and added "that they seem somewhat out of proportion to the size of the fungus." Hoffman says "potius capsa seminalis quam semen ipsum"—"they are less seeds than capsules filled with seeds," while Micheli said that the spores are hard to see with a good magnifying glass.

These fungi have had several popular names, probably owing to their quaint and attractive appearance. Besides the well-known name of "bird's-nest fungi," as far back as 1724 they have been "called in Worchestershire cornbells, where they grow plentifully,"† and in Lincolnshire "we find that a kind of fungus like a cup or old-fashioned purse with small objects inside is called a 'fairy purse' and we presume that the small objects represent the fairies' cash."‡

Synopsis of the Genera of the Nidulariaceae

Sporangioles attached to the inner wall of the peridium.

Peridium composed of three layers; spores mixed with filaments. I. CYATHIA.

*Most of what follows in this paragraph is translated and adapted from Tulasne's monograph, pages 54–56, as several of the works referred to were unfortunately unobtainable.

† Ray, Syn. Ed. 3, 2: 20. 1724.

‡ Friend, Flower Lore, 34. 1889.

Peridium composed of one homogeneous layer; spores not mixed with filaments. II. CRUCIBULUM.

Sporangioles not attached to the inner wall of the peridium.
Peridium thick, opening by a regular definite mouth. III. NIDULA.
Peridium thin, rupturing irregularly. IV. GRANULARIA.

I. CYATHIA P. Br., Civ. and Nat. Hist. Jamaica, 78. 1756
Cyathus Hall. Stirp. Helvet. **3**: 127. 1768

Peridium composed of three distinct but closely connected layers. Mouth at first closed by a membrane (epiphragm), usually white, opening at maturity; sporangioles flattened, umbilicate beneath, attached to the inner wall of the peridium by a complex elastic cord (funiculus), and with thick horny filaments intermixed with the spores.

Clusius,* in 1601, made the first mention of a *Cyathia* under the name of fungus minimus *ανώνυμος*, and described it in Latin, the following being a free translation of the entire paragraph: "Moreover this fungus, which I will call anonymous, is very different from the preceding ones, and I consider it to be the smallest of all, for it is barely half an inch high. In the fall a great many grow, without petiole, on wooden boards away from dust and sand. They have the color of cinders or are of a lifeless color. The shape, which is so small, appears to be undeveloped, scarcely as large and as thick as the top of a little finger. Sometimes they grow alone or when in numbers two, three or four adhering together, and when ripe, they throw off the top part and appear full of a viscous juice, and of seeds which are about the size of the seeds of cyclamen, but have the outline of small fungi and are apparently cinder-colored. There is no doubt that this fungus grows in Italy, for I remember that a friend of mine sent me, once upon a time from there, some of these seeds, dried and with a certain strange name, asking me if I could find out what they were. For there are certain characters who endeavor to catch and buy praise from the ignorance of others."

There seem to be no intermediate references to this plant until 1671, when Bauhin † mentioned "Fungus minimus lignelis tabellis areolarum hortorum adnascens." Mentzel,‡ in 1682 first figured

* Rar. Plant. Hist. cclxxxvii. 1601.
† Pinax, Lib. X., Sec. 5, no. 39, 374. 1671.
‡ Ind. Nom. Plant. Univ. *pl. 6.* 1682.

a plant which was, without doubt, *Cyathia lentifera*. Loeselius,* and Marsilius,† made passing references to this same species, and in 1729 Micheli ‡ described and figured two species, citing one from the above-mentioned writers, and the second from Ray,§ Dillenius ‖ and Vaillant,¶ the latter species being unquestionably *Cyathia striata*. Linnaeus,** in 1753, gives under his section "Acaules" of the genus *Peziza*—*Peziza campanulata lentifera*, first referring to Hortus Cliffortianus (1737) where we find that the only species of *Peziza* which he gives, and to which he refers what is evidently a *Cyathia* is not a *Peziza* in the modern sense, but the first known type of *Cyathia;* and the only proof that he knew what a *Peziza* really was, is his reference to Dillenius'†† work published in 1719, in which a true *Peziza* is figured. Dillenius divided the *Pezizae* into two sections: (1) *Membranacei et tenuiores*—the true *Pezizae*, and (2) *Duriores calyciformes, seminiferi putati*, under which head he gives *Peziza calyciformis lentifera laevis* (our *Cyathia lentifera*) and *Peziza calyciformis lentifera hirsuta*" (our *Cyathia hirsuta*).

The genus *Cyathus* was founded in 1768 by Haller, twelve years after *Cyathia* P. Br., and since that time many species have been described from nearly all parts of the world. Fischer‡‡ states that there are forty-two known species.

From our own country not many species have been described, Schweinitz was the first to mention these plants; in 1818 he named ten species, but not all of them are to be referred to the genus *Cyathia*. In 1869 Berkeley & Curtis§§ described *Cyathus pallidus* from Cuba, also reporting *Cyathus intermedius*, *Cyathus Montagnei*, *Cyathus limbatus*, *Cyathus Poeppigii*, *Cyathus microsporus*, and *Cyathus Lesueurii* collected by Wright from the same island. Berkeley,‖‖ in 1873, described from Connecticut, *Cyathus Wrightii*,

* Flor. Prus. 98. 1703.
† Dissert. Gen. Fung. 17. *pl. a.* 1714.
‡ Nov. Plant. Gen. 222. *pl. 102. f. 1, 2.* 1729.
§ Syn. 3: 21. 1704.
‖ Giss. 196. 1719.
¶ Bot. Paris. 57. *pl. 11. f. 4, 5.* 1727.
** Sp. Pl. 2: 1180. 1753.
†† *l. c.*
‡‡ Engler & Prantl, Nat. Pflanzenfam. 1^{1**}: 328. 1899.
§§ Jour. Linn. Soc. 10: 346. 1869.
‖‖ Grevillea, 2: 34. 1873.

which has not since been reported. *Cyathus rufipes* was described in 1897 by Ellis & Everhart * from Kansas, and the next year Hennings, † described *Cyathus niveotomentosus* from California.

The following summary will show the distribution of the known species of *Cyathia*:

EUROPE, 7 species: *C. complanata, C. deformis, C. fimetaria, C. hirsuta, C. lentifera, C. subiculosa, C. umbrina.*

ASIA, 6 species: *C. emodensis, C. Hookeri, C. intermedia, C. minima, C. Montagnei, C. sulcata.*

AFRICA, 5 species: *C. affinis, C. dasypus, C. pallida, C. hirsuta, C. lentifera.*

AUSTRALIA, 9 species: *C. Baileyi, C. desertorum, C. fimicola, C. intermedia, C. stercorea, C. Montagnei, C. pezizoides, C. pusio, C. lentifera.*

NEW ZEALAND, 3 species: *C. Colensoi, C. Novae-Zelandiae, C. similis.*

NORTH AMERICA, 11 species: *C. intermedia, C. lentifera, C. melanosperma, C. Berkleyana, C. rugisperma, C. rufipes, C. hirsuta, C. stercorea, C. pallida, C. Wrightii, C. fragilis.*

CUBA, 7 species: *C. intermedia, C. Montagnei, C. pallida, C. limbata, C. Poeppigii, C. Berkleyana, C. stercorea.*

SOUTH AMERICA, 12 species: *C. ambigua, C. dasypus, C. limbata, C. microspora, C. Montagnei, C. plicata, C. Poeppigii, C. Puiggarii, C. scutellaris, C. hirsuta, C. lentifera, C. Gayana.*

Synopsis of the Species of Cyathia

Peridium sulcate-striate within.
- Spores large, more than 35 μ long. — 1. *C. Poeppigii.*
- Spores small, less than 8 μ long. — 2. *C. Berkleyana.*
- Spores of medium size, 12–20 μ long.
  - Peridium sparingly clothed with short fasciculate hairs without. — 3. *C. intermedia.*
  - Peridium thin, shaggy-tomentose without. — 4. *C. hirsuta.*
  - Peridium very tough and brittle, rough tomentose. — 5. *C. dura.*

Peridium faintly striate near the mouth, not sulcate within. — 6. *C. Montagnei.*

Peridium smooth within, not sulcate.
- Spores large, more than 40 μ long. — 7. *C. melanosperma.*
- Spores small, less than 15 μ long.
  - Sporangioles darkish; margin of peridium straight.
    - Peridium smooth or nearly so. — 8. *C. pallida.*
    - Peridium strigose-tomentose. — 9. *C. rugisperma.*
  - Sporangioles light colored; margin of peridium often recurved. — 10. *C. lentifera.*
- Spores of medium size, 15–30 μ long.
  - Peridium with a red felt-like mycelial bulb at base. — 11. *C. rufipes.*
  - Peridium with a thick bulb of whitish mycelium. — 12. *C. Wrightii.*
  - Peridium scarcely thickened at the base. — 13. *C. stercorea.*

* Bull. Torrey Club, 24: 125. 1897.

† Hedwigia, 37: 274. 1898.

1. **Cyathia Poeppigii** (Tul.)

Cyathus Poeppigii Tul. Ann. Sci. Nat. III. **1**: 77. *pl. 4. f. 23–25; pl. 5. f. 3–4.* 1844.

Peridia slender, goblet-shaped, 7–12 mm. high, 5–7 mm. wide at the top, about 1 mm. at the base of the stem, dark chocolate-brown, the outer surface somewhat shaggy, peeling, leaving a comparatively smooth, deeply and closely striated surface, corresponding with the deep inner striations, the inner surface brown, somewhat lighter colored than the outer surface, somewhat shiny, deeply striate; mouth minutely fimbriate; sporangioles blackish, flattened, dull, 2–2.5 mm. in diameter; funiculus long; spores 38–45 μ long, 18–22 μ in diameter, very thick-walled, granular within, oblong and often slightly curved. (*Pl. 14. f. 1–4.*)

Growing singly and in groups on manure and wet ground.

ST. CROIX (Danish West Indies): *A. E. Ricksecker.*

This species was originally described from Cuba and French Guiana; it is easily distinguished from the other striated species of *Cyathia* by its unusually large spores, and by its deeply and closely striated outer surface.

2. **Cyathia Berkleyana** (Tul.)

Cyathus microsporus β Berkleyanus Tul. Ann. Sci. Nat. III. **1**: 74. 1844.

Peridia small, cup-shaped, 5–8 mm. high, 5–7 mm. wide at the top, very much narrowed and rounded at the base, brownish outside and somewhat shaggy; mouth finely fimbriate, the inner surface of the peridium shiny, grayish-brown, lighter colored than the outer, coarsely striate; sporangioles small, 2 mm. in diameter, shiny, nearly black, flattened; spores small, 6–8 μ long, 4–6 μ wide, somewhat thick-walled, hyaline. (*Pl. 14, f. 5–7.*)

On decayed stems of coarse herbaceous plants.

JAMAICA: *Cockerell.*

This species was originally described from Brazil; it somewhat resembles small specimens of *Cyathia hirsuta*, but it differs from that species in the texture of the outer coat, which is much less shaggy and thick, and in the much smaller spores.

3. **Cyathia intermedia** (Mont.)

Nidularia intermedia Mont.; Sagra, Hist. Phy. Pol. Cuba, 321. 1838–42.

Cyathus intermedius (Mont.) Tul. Ann. Sci. Nat. III. **1**: 72. *pl. 4. f. 4–7.* 1844.

Peridia cup-shaped, not rounded at the base, 7–9 mm. high, 6–8 mm. wide at the top, 1–2 mm. at the base, lightish brown, clothed with fine hairs which grow in clusters, the tips of several of which join together in little outwardly curved tufts, thin and showing the inner sulcate markings through in the older peridia; inner surface brown, shiny, sulcate-striate; the mouth straight, not flaring, clothed with a circle of short stiff bristles; the sporangioles about 2 mm. in diameter, flattened, blackish, depressed beneath, somewhat angular with a short attachment; spores hyaline, 12–18 μ long, 6–9 μ wide, thick-walled. (*Pl. 14. f. 8–10; pl. 18. f. 18.*)

Growing in loose soil and on decaying wood.

[CUBA: *Ramon de la Sagra.*]

DELAWARE: Faulkland, *Commons.*

This species was originally described from Cuba; it differs from *Cyathia hirsuta* in the character of the tomentose outer covering of the peridium, and in the shorter and more rudimentary attachment of the sporangioles to the inner peridial wall.

4. **Cyathia hirsuta** (Schaeff.)

Peziza lentifera β Linn. Sp. Pl. **2**: 1180. 1753.

Peziza sessilis campanulata villosa Scop. Fl. Carn. 57. 1760.

Peziza prima Schaeff. Fung. Bav. et Palat. Icon. **2**: *pl. 178.* 1763.

Cyathus hirsutus intus striatus Hall. Stirp. Helvet. **3**: 127. 1768.

Peziza cyathiformis Scop. *p. p.** Fl. Carn. **2**: 486. 1772. [Ed. 2.]

Peziza hirsuta Schaeff. Fung. Bav. et Palat. **4**: 124. 1774.

Peziza striata Huds. Flor. Ang. 634. 1778. [Ed. 2.]

Peziza hirsuta Batsch, Elench. Fung. 127. 1783.

Nidularia striata With. Bot. Arrang. **3**: 446. 1792 [Ed. 2]; Sibth. Fl. Ox. 393. 1794; Fries. Syst. Mycol. **3**: 298. 1822; Schwein. Trans. Amer. Phil. Soc. **4**: 252. 1834.

Cyathus striatus Willd. Fl. Berol. 399. 1787; Hoffm. Veg. Crypt. fasc. **2**: 33. *pl. 8. f. 3.* 1790; Pers. Syn. Meth. Fung. 237. 1801; Nees, Syst. 140. 1817; DC. Fl. Fr. **2**: 269. 1805; Tul. Ann. Sci. Nat. III. **1**: 67. 1844.

* As the first cited reference under the description of this species belongs to *C. lentifera* this name cannot be taken up for this species.

Peridia 10–15 mm. high, 8–10 mm. wide at the top, 2–4 mm. at the base, usually straight trumpet-shaped, very gradually spreading toward the top; outer surface of the peridium dark brown, shaggy fibrillose; inner surface brown or grayish-brown, shiny, striate-sulcate for about one half the height of the peridium, becoming smooth at the base; mouth densely clothed with a circle of stiff regular bristles; sporangioles darkish, 2 mm. in diameter, shiny, depressed beneath, and somewhat angular from the pressure of one upon the other; spores 12–18 μ long, 6–9 μ wide, thick-walled, hyaline, somewhat crescent-shaped. (*Pl. 14. f. 11–14; pl. 18. f. 1–6.*)

Growing singly and in clusters, on sticks, bark, etc.

EXSICC.: Ellis, North American Fungi, 729.

NEW YORK: *Underwood, Tooke, Clinton, Brown, Murrill;* MAINE: *Harvey;* CONNECTICUT: *White;* PENNSYLVANIA: *Gentry, Lloyd;* OHIO: *Lloyd, James;* GEORGIA: *Underwood;* ALABAMA: *Earle;* IOWA: *Langlois;* WISCONSIN: *Williams;* INDIANA: *Underwood;* MONTANA: *Anderson, no. 601;* COLORADO: *Bethel;* WASHINGTON: *Suksdorf;* CANADA: *Dearness;* PUERTO RICO: *Underwood & Griggs;* MEXICO: *Egeling.*

Tulasne* has given an account of the development of this species from which the following is freely translated:

The young plants arise on the thick felt-like mycelium in the shape of small cylindrical jelly-like masses. They are at first white and smooth, gradually changing to a brown color and their surface becomes somewhat scaly. The three coats which compose the peridium are indicated at this stage, when the outer brownish scaly portion begins to form itself into the outer coat, while the walls of the white glutinous inner substance become differentiated from the fruiting portion into a very thin membrane which encloses these parts, a thin portion of the glutinous membrane remaining between these two coats welding them together and so forming the triple peridial wall. It is now that the sporangioles begin their growth, gradually absorbing the surrounding substance into themselves, so that when the plant is mature and gradually opens, the sporangioles alone remain within the cup attached to the sides of the peridium by means of a funiculus of a complicated structure. The sporangioles are in most

* Ann. Sci. Nat. III. 1: 50–54. *pl. 3; pl. 4. f. 1–3; pl. 8. f. 1–12.* 1844.

cases composed of three parts, namely, of a thick and usually dark colored coat, a light hyaline thickly interwoven portion which bears the basidia, which in their turn bear the spores. The center part is composed of innumerable spores mixed with branching filaments. The walls of the spores are very thick, these spores having long been separated from their basidia. The funiculus is composed of three parts; the lower portion is variable as to length and thickness, its lower extremity is expanded and attached to the peridium; the upper portion is more regular in shape and is attached by its upper extremity to the sporangiole; it is rather swollen in the center, in which portion there is enclosed a long and slender filet composed of innumerable hyaline, interwoven filaments, which can be drawn out if great care is used in the process and forcibly distended without breaking, according to Tulasne to a length of 12 cm. These two parts are joined by a much narrower and shorter portion to which Tulasne gives the name of "filet médian."

4a. CYATHIA HIRSUTA **infundibuliformis** var. nov.

Peridia 1.5–18 cm. high, funnel-shaped, 1–2 cm. wide at the top, 1.5–2 mm. at the base, 4–5 mm. in the center where the peridium is contracted; outer surface of the peridium brownish, coarsely shaggy-tomentose; inner surface dull brownish, clearly striate, but not below the contraction; mouth minutely fimbriated; sporangioles dull brownish, 2 mm. in diameter, flattened; spores 8–12 μ wide, 14–17 μ long, thick-walled, hyaline. (*Pl. 14. f. 15.*)

Growing singly on leaves and moss.

MONTANA: Sheridan, *Fitch.*

This variety differs from the type in the definite funnel-shape of the peridium, and in the nature of the tomentum, and to a less degree in the size of the spores. Further material may necessitate a different treatment.

5. **Cyathia dura** sp. nov.

Peridia flaring trumpet-shaped, 8–13 mm. high, 8–12 mm. wide at the top, 2–4 mm. at the base, brownish-gray outside, rough, shaggy, and very tough and brittle; inner surface whitish, dull, and marked with rather wide shallow striations; mouth recurved, ragged and much split, but not fimbriate; bases of the peridium contracted and in some specimens there is a thick felty

brown mycelial band adhering; sporangioles dull grayish, oval or rounded, 2.5 mm. long, 1.5 mm. wide; spores 14–18 μ long, 8–10 μ wide, hyaline and thick-walled. (*Pl. 14. f. 16–19.*)

COLORADO: Denver, *Bethel, 8.*

This species differs from all others seen in the character of the peridium, which is very thick, hard and brittle.

6. **Cyathia Montagnei** (Tul.)

Cyathus Montagnei Tul. Ann. Sci. Nat. III. **1**: 70. *pl. 4, f. 9–11.* 1844.

Peridia 8–10 mm. high, 6–9 mm. wide at the top, 2–3 mm. at the base, spreading, cup-shaped, reddish-brown outside, closely woolly-tomentose, but not shaggy, rather thin; inner surface grayish, dull, faintly striate close to the top, not sulcate; mouth at first curved inwards, then straight, but not recurved, closely and very minutely fimbriate; sporangioles 2 mm. in diameter, grayish, black, somewhat lighter beneath, dull, flattened, angular; spores 15–18 μ long, 8–12 μ wide, thick-walled, granular, hyaline. (*Pl. 14. f. 20–22.*)

On the ground and on decaying wood and chips.

YUCATAN: *C. F. Millspaugh, 787*; [CUBA].

This species was originally described from Brazil; it is readily distinguished from the preceding species: (1) By the faint and only partial striae of the upper part of the inner surface of the peridium, and (2) By the woolly tomentose, and not shaggy nature of the outer coat.

7. **Cyathia melanosperma** (Schwein.)

Nidularia melanosperma Schwein. Trans. Am. Phil. Soc. **4**: 253. 1834.

Cyathus melanospermus (Schwein.) De Toni; Saccardo, Syll. Fung. **7**: 42. 1887.

Peridia cup-shaped, clustered, 5–7 mm. high, 5–6 mm. wide at the top; the outer surface brownish and very shaggy; the inner surface smooth, shiny, dark gray; mouth straight and slightly fimbriate; sporangioles black, flattened, about 2 mm. wide; spores large, 45–55 μ long, 18–45 μ wide, very thick-walled, granular within, hyaline. (*Pl. 15. f. 1–4.*)

Gregarious on the earth.

PENNSYLVANIA: Bethlehem, *Schweinitz.*

The above description is based on Schweinitz's original speci-

mens, which are still in good condition at the Philadelphia Academy of Sciences. This appears to be a rare species, as it is known only from its original collection. It differs from all the following species of *Cyathia*, which have a smooth inner surface, in having a fimbriate mouth, though Schweinitz in his original description notes that it has a smooth mouth, but he writes that *Nidularia stercorea* has a fimbriate mouth, which is contradicted by his own specimens.

8. **Cyathia pallida** (B. & C.)

Cyathus pallidus B. & C. Jour. Linn. Soc. **10**: 346. 1869.

Peridia 4–8 mm. high, 5–7 mm. wide at the top, about 2 mm. at the base, slender urn-shaped, slightly expanded at the top and contracted at the base, thin and membranous, fawn-colored outside, and minutely shaggy; inner surface light lead-colored, smooth, shiny; mouth entire or torn but not fimbriate, sometimes slightly striated; sporangioles 2 mm. in diameter, flattened, the edges very thin, and thicker in the middle, darker above than below, shiny as if frosted, and under high magnification showing a network of delicate rugose wrinkles; spores 5–9 μ long, 5–7 μ wide, hyaline, thick-walled, oval-pointed or nearly round, pale yellow in the mass. (*Pl. 15. f. 5–7.*)

Growing on decayed wood.

CUBA: *Wright;* PUERTO RICO: Coamo Springs, *Underwood & Griggs.*

The above description is based on the co-types of this species in the Curtis collection at Harvard University.

9. **Cyathia rugisperma** (Schwein.)

Nidularia rugisperma Schwein. Trans. Am. Phil. Soc. **4**: 253. 1834.

Cyathus rugispermus (Schwein.) De Toni; Saccardo, Syll. Fung. **7**: 42. 1888.

Peridia somewhat obconic, sharply contracted at the base, 5–8 mm. high, 4 mm. wide at the top; outer surface lightish fawn-colored, strigose-tomentose, becoming nearly smooth when mature; inner surface darkish brown, smooth, and shiny; mouth incurved in the young peridia, and completely covered by the tomentose outer covering; sporangioles black, flattened, roundish, 1–1.5 mm. in diameter; spores 10–14 μ long, 8–10 μ wide, somewhat granular and thick-walled, hyaline. (*Pl. 16. f. 3–6.*)

Growing singly on bits of shaving and fibrous matter.

PENNSYLVANIA: Bethlehem, *Schweinitz.*

The above description is based on the original specimens. Schweinitz, in his description of this species, says: "Sporangiis non nitentibus, sed superficie reticulato-rugosa," but no such markings were noticeable.

This is a pretty little species, and is known only from its original collection.

10. **Cyathia lentifera** (L.)

Peziza lentifera α Linn. Sp. Pl. **2**: 1180. 1753.

Peziza sessilis campanulata laevis Scop. Fl. Carn. 57. 1760.

Peziza tertia Schaeff. Fung. Bav. et Palat. Icon. **2**: *pl. 180.* 1763.

Cyathus sericeus intus laevis Hall. Stirp. Helvet. **3**: 127. 1768.

Peziza cyathiformis Scop. *p. p.* Fl. Carn. **2**: 486. 1772 [Ed. 2].

Peziza sericea Schaeff. Fung. Bav. et Palat. **4**: 125. 1774.

Peziza lentifera Huds. Fl. Ang. **2**: 633. 1778 [Ed. 2].

Peziza Olla Batsch, Elench. Fung. 127. 1783.

Nidularia vernicosa Bull. Champ. **1**: 164. *pl. 488. f. 1.* 1791.

Cyathus laevis Hoffm. Veg. Crypt. fasc. 2: 31. *pl. 8. f. 2.* 1792.

Coccigrue à lentilles Paulet. Tr. des Champ. **2**: 406. *pl. 187. f. 7–12.* 1793.

Nidularia campanulata With. Bot. Arrang. **3**: 445. 1792 [Ed. 2]; Sibth. Fl. Ox. 393. 1794; Fries, Syst. Myc. **2**: 298. 1822.

Cyathus Olla Pers. Syn. Meth. Fung. 237. 1801.

Cyathus vernicosus DC. Fl. Fr. **2**: 270. 1805; Tul. Ann. Sci. Nat. III. **1**: 81. *pl. 5. f. 14–23.* 1844.

Nidularia plumbea Pers. Champ. Comest. 110. 1818.

Nidularia fascicularis Schwein. Trans. Am. Phil. Soc. **4**: 253. 1834.

Cyathus campanulatus Corda, Anleit. lxxx. *pl. D. f. 42* (*19–23*). 1842.

Peridia 8–12 mm. high, 5–15 mm. wide at the top, 2–7 mm. at the base, campanulate, the edge often recurved and expanded; outer surface lightish brown or grayish-yellow, almost smooth, sometimes having a few tow-like fibers attached which give it a slightly roughened appearance; inner surface smooth, whitish or lead-colored, shiny; mouth entire, often ragged and split; sporangioles light-colored, 2–3 mm. in diameter, flattened beneath; spores 8–15 μ long, 6–10 μ wide, thick-walled, hyaline. (*Pl. 15. f. 8–13.*)

Plants sessile, or sometimes stalked, growing singly or in clusters on the earth, on dry chips, twigs, etc.

NEW YORK: *Underwood;* MAINE: *Harvey, Bartle;* CONNECTICUT: *White;* PENNSYLVANIA: *Martin;* ALABAMA: *Earle;* INDIANA: *Underwood;* KANSAS: *Bartholomew, 1032;* COLORADO: *Ravenel;* UTAH: *Harkness;* CALIFORNIA: *Orcutt, Baker;* TEXAS: *Young;* PUERTO RICO: *Goll.*

11. **Cyathia rufipes** (Ell. & Ev.)

Cyathus rufipes Ell. & Ev. Bull. Torrey Club, **24**: 125. 1897.

Peridia very slender, obconic, .8–1.5 cm. high, 3–6 mm. wide at the top, 1–1.5 mm. at the base, outer surface lightish brown or tow-colored, very shaggy tomentose, and with a quantity of reddish-brown mycelium adhering at the base, forming a felt-like tuft; inner surface smooth, dark gray, shiny; sporangioles 2 mm. in diameter, dark, almost black, shiny, depressed beneath; spores 25–29 μ long, 18–22 μ wide, thick-walled, granular within and hyaline. (*Pl. 15. f. 14–16.*)

On old sods, "growing head downward."

KANSAS: *Bartholomew;* NEBRASKA: *Bates.*

This species is readily distinguished from the other species of *Cyathus* with a smooth inner surface by its very slender elongated shape and its light densely tomentose peridium, besides the characteristic feature of the red felt-like mycelial tuft at the base, from which the species derives its name.

12. **Cyathia Wrightii** (Berk.)

Cyathus Wrightii Berk. Grevillea, **2**: 34. 1873.

Peridia rather large, cup-shaped, 1.2–1.8 cm. high, .5–1.2 cm. wide at the top, contracted somewhat at the base, then bulbose, the bulb composed of mycelium and adhering earth; outer surface darkish brown, very rough, shaggy and encrusted with earth; inner surface smooth, shiny, darkish; mouth entire, not fimbriate though the fine hairs circle up about it; sporangioles dark, 1.5–2 mm. in diameter, shiny, flattened; spores 22–25 μ long, 15–18 μ wide. (*Pl. 16. f. 7–9.*)

CONNECTICUT: Growing singly on earth, *C. Wright.*

This species is not known to have been reported since the original collection. The above description of external characters is based on the cotypes at Harvard University. The spores were

not seen; the measurement being taken from some mss. notes on *Cyathus* by Massee, made from the type of *C. Wrightii* at Kew. De Toni gives the measurement in Saccardo as "15 μ long by 10 μ wide."

13. **Cyathia stercorea** (Schwein.)

Nidularia stercorea Schweinitz, Trans. Am. Phil. Soc. **4**: 253. 1834.

Cyathus Lesueurii Tul. Ann. Sci. Nat. III. **1**: 79. *pl. 5. f. 5–13.* 1844.

Cyathus Lesueurii, var. *minor* Tul. *l. c.* 80.

Cyathus stercoreus (Schwein.) De Toni; Saccardo, Syll. Fung. **7**: 40. 1888.

Peridia slender, campanulate, sessile or with an elongated slender base, .5–1.5 cm. high, 4–8 mm. wide at the top, 1–3 mm. at the base; outer surface brownish fawn-colored, the young plants being strigose with a copious covering of shaggy hairs, which gradually disappear, leaving the mature peridium almost smooth, or marked with circular depressed zones; inner surface smooth, shiny, lead-colored, somewhat darker toward the base; the mouth entire or at first appearing fimbriate from the surrounding hairy covering, but not ciliate-fimbriate; sporangioles blackish-lead-colored, smooth, shiny, 2 mm. in diameter, depressed beneath; spores 25–30 μ long, 20–25 μ wide, thick-walled, hyaline, granular within. (*Pl. 15. f. 17–20; pl. 16. f. 1, 2.*)

Growing on manure, bits of wood, etc.

EXSICC.: E. & E. Fungi Columbiani, 644 (as *Cyathus vernicosus*); Ravenel, Fungi Amer. Exsic. 473 (as *Cyathus vernicosus*), 474 (as *Cyathus Lesueurii*); Ravenel, Fungi Car. Exsic. **3**: 73 (as *Cyathus campanulatus*); Ellis, N. A. Fungi, 1308 (*Cyathus vernicosus*); Shear, N. Y. Fungi, 316.

PENNSYLVANIA: *Schweinitz;* NEW YORK: *Underwood, Shear, Brown, Vail;* MASSACHUSETTS: *Ellis, Knight;* MAINE: *Harvey;* NEW JERSEY: *Ellis;* DELAWARE: *O. S.;* SOUTH CAROLINA: *Ravenel;* VIRGINIA: *Murrill;* IOWA: *Langlois;* INDIANA: *Underwood, Arthur;* OHIO: *Morgan, Lloyd;* ALABAMA: *F. S. Earle & C. F. Baker,* Tuskegee, *Carver;* KANSAS: *Cragin, 273;* COLORADO: *Baker;* NEBRASKA: *Williams;* NEW MEXICO: *F. S. Earle & E. S. Earle Cockerell;* CANADA: *Dearness, 1149.*

This species varies very much as to size, shape and smoothness of the peridium, which facts have been rather misleading, but

such different types have been found in specimens from one locality from the short, strigose, sessile or bulbose form to the slender, almost smooth, elongated form—that there can be no question as to their being in reality but one species. Tulasne does not mention Schweinitz's *Nidularia stercorea*, and his species *Cyathus Lesueurii* from New Orleans was presumably described without knowledge of the preceding species. His variety *Cyathus Lesueurii* var. *minor* from Carolina, closely resembles small forms of *Cyathia stercorea*.

CYATHIA (?) sp.

Peridia cup-shaped, clustered, 4–6 mm. high, 3–5 mm. wide at the top, 2 mm. at the base; outer surface lightish brown, nearly smooth, or minutely fibrous; inner surface smooth, very dark brown, almost black, shiny; mouth entire or slightly ragged, but not fimbriate; sporangioles black, shiny, angular beneath, rounded above, 1 mm. in diameter, showing no trace of any attachment, numerous; spores 20–30 μ long, 18–24 μ wide, thick-walled, granular within, hyaline. (*Pl. 16. f. 16, 21, 22.*)

No mention as to habitat.

The specimens on which the above description is based were sent to Mr. Ellis by Professor E. Bethel (no. 9) from Denver, Colorado, and were named *Cyathus vernicosus*. They consist of four or five groups of from two to five plants in each. The peridial wall is triple and the structure of the sporangioles is much as in *Cyathia*, the spores being also intermixed with thick horny filaments as in that genus; but there is no trace whatever of any attachment either on the under surface of the sporangioles or on the inner surface of the peridium. The specimens are all mature, so it is impossible to know what the nature of the young peridia was, but the sporangioles are still in the peridia, filling them completely, even with the margin quite unlike anything seen belonging to the genus *Cyathia*. It is very possible that a genus standing in the same relation to *Cyathia*, as *Nidula* does to *Crucibulum*, will eventually have to be established to accommodate these forms, but the material and data are not sufficient to justify taking such a step at present.

SPECIES INQUIRENDA

CYATHUS NIVEO-TOMENTOSUS P. Henn. Hedwigia, **37**: 274. 1898

Sparsis: peridio obconico-cyathiformi, crassiusculo papyraceo primo operculo albo tecto, sessili vel substipitato, extus niveo

sericeo, dense tomentoso, margine integro, crasso, 3–5 mm. alto, 4–5 mm. lato, intus albo-flavescente; sporangiolis innumeris, lentiformibus, planis, tenue tunicatis, cinnamomeis, sericeis, 1–1.2 mm. diametro; sporis ellipsoideis, obtusis, intus granulatis, hyalinis, 7–8.5 × 4.5–5.5 μ, episporio hyalino, tenui, levi.

CALIFORNIA: Potter Valley. On decaying wood (Sept. 1894). *Purpus.*

The original description is quoted, as no specimens of this species were seen, and until more material has been collected it is difficult to decide with any degree of certainty just where it belongs. The author adds that this species appears to be related to *Cyathia pallida.*

II. CRUCIBULUM Tul. Ann. Sci. Nat. III. 1: 89. 1844

Peridium composed of a single, homogeneous, though sometimes layered, felt-like membrane, which is at first continuous over the mouth, forming a sort of epiphragm; sporangioles more numerous than in the preceding genus, and the funiculus is much less complex, consisting of a little bundle of elastic filaments gathered closely together in a very thin, hardly noticeable outer covering, the upper end of which is attached to a nipple-like protuberance on the under surface of the sporangiole, and the lower end is attached to the inner wall of the peridium; there are no filaments intermixed with the spores.

Although the genus *Crucibulum* was not founded until 1844, for nearly a century and a half plants belonging to it have been known and unmistakably figured. Ray* in 1696, in a list of plants collected by D. Samuel Doody, mentions "Fungus seminifer minor," which he figured in 1724.† Micheli, five years later, gave a good figure of *Crucibulum crucibuliforme.* As early as 1697 Boccone‡ figured this plant, under the name of "Fungus σπερματιας calyculatus," but does not seem to give it more than this passing notice. Gleditsch,§ Schaeffer,‖ Scopoli,¶ Hudson,** Hoffman†† and others made mention of this plant, under various names, but

*Syn. 333. 1696. [Ed. 2.]
†Ray, Syn. 20. *pl. 1. f. 2 b, c.* 1724. [Ed. 3.]
‡Mus. Fis. *pl. 301. f. 1.* 1697.
§Meth. Fung. 138. *pl. 4.* 1753.
‖Fung. Bav. et Palat. Icon. 2: *pl. 179.* 1761; 4: 125. 1774.
¶Flor. Carn. 2: 486. 1772. [Ed. 2.]
**Flor. Ang. 2: 634. 1778. [Ed. 2.]
††Vegt. Crypt. fasc. 2: 29. *pl. 8. f. 1.* 1790.

not until 1801, was the present generic name employed by Persoon *—even then only to denote a species—*Cyathus Crucibulum.*

Schweinitz was the first to report *Crucibulum crucibuliforme* from this country under the name of *Nidularia Crucibulum.* He also described another species, *Nidularia juglandicola* which though retained as a good species of *Crucibulum* by De Toni,† proves to be a form of *Crucibulum crucibuliforme*, slightly larger and more flaring, but otherwise similar to the type species. Though the genus as represented by *Crucibulum crucibuliforme* is comparatively common and widely distributed, it is interesting to note in contrast with the genus *Cyathia*, which is very prolific of species, that only one other species has been described, viz., *Crucibulum simile* Massee ‡ from New Zealand and Australia, and even this is said to resemble *Crucibulum crucibuliforme* closely.

Bulliard § says that there are two varieties of *Crucibulum* both of which he figures, one glabrous, almost as smooth inside as out, the other smooth inside but somewhat tomentose on the outside, and always larger and more yellow than the first. It has been noticed in examining quite a number of specimens from different localities that those collected in one place often vary greatly in size and color, and in the nature of the tomentose outer surface of the peridium. Cooke,‖ in 1879, described a variety which he calls *lanosum*, and which De Toni says might possibly be Bulliard's second variety (figured on *pl. 40*) but as Cooke described it as "paler than in the usual form" this disposition cannot be correct.

1. **Crucibulum crucibuliforme** (Scop.)

Peziza sessilis campanulata (b) Gled. Meth. Fung. 138. *pl. 4.* 1753.

Peziza secunda Schaeff. Fung. Bav. et. Palat. Icon. **2**: *pl. 179.* 1763.

Peziza lentifera Oeder, Fl. Dan. **2**: 9. *pl. 105.* 1763; not Linnaeus.

Peziza crucibuliformis Scop. Flor. Carn. **2**: 486. 1772 [Ed. 2]; Schaeff. Fung. Bav. et Palat. **4**: 125. 1774.

* Syn. Meth. Fung. 239. 1801.
† Saccardo, Syll. Fung. **7**: 44. 1888.
‡ Grevillea, **19**: 93. 1891.
§ Champ. **1**: 165. *pl. 40* and *pl. 488.* 1809.
‖ Grevillea, **8**: 58. 1879.

Peziza laevis Huds. Fl. Ang. 634. 1778. [Ed. 2.]

Cyathus cylindricus Willd. Fl. Berol. 399. 1787.

Cyathus crucibuliformis Hoffm. Veg. Crypt. fasc. 2, 29. *pl. 8. f. 1.* 1790.

Nidularia laevis Bull. Champ. **1**: 164. *pl. 448. f. 2. pl. 40.* 1791; With. Bot. Arrang. **3**: 446. 1792 [Ed. 2]; Sibth. Fl. Ox. 393. 1794.

Cyathus Crucibulum Pers. Syn. Fung. 238. 1801; Nees, Syst. 140. *pl. 13. f. 133.* 1817.

Cyathus laevis DC. Fl. Fr. **2**: 269. 1805.

Nidularia Crucibulum Secret. Mycogr. Suisse, **3**: 378. 1833; Schwein. Trans. Am. Phil. Soc. **4**: 253. 1834.

Nidularia juglandicola Schwein. Trans. Am. Phil. Soc. **4**: 253. 1834.

Crucibulum vulgare Tul. Ann. Sci. Nat. III. **1**: 90. *pl. 6. f. 9–24. pl. 7. f. 1. pl. 8. f. 13–17.* 1844.

Crucibulum juglandicolum De Toni; Sacc. Syll. Fung. **7**: 44. 1888.

Peridia 5–10 mm. high, 5–10 mm. across at the top, 4–7 mm. at the base, cylindrical-campanulate, base truncate or but slightly contracted; outer surface dirty cinnamon or grayish fawn-color, young plant minutely velvety tomentose, becoming smoother with age; the inner surface smooth, shiny and whitish; mouth entire, firm and even, sometimes slightly contracted, sporangioles pale ochraceous, becoming whitish, 1.5–2 mm. in diameter, very numerous and crowded, flattened beneath; spores hyaline, elliptic, 8–10 μ long, 4–6 μ wide, smooth, some thick-walled. (*Pl. 16. f. 10–15; pl. 18. f. 7–13 and 16.*)

Plants gregarious or single on twigs, old bagging, chips, etc.; common and variable.

EXSIC.: Ellis, N. A. Fungi, no. 728; Ravenel, Fungi Amer. Exsic. no. 139.

NEW YORK: *Underwood, Clinton, Jelliffe;* MAINE: *Harvey;* CONNECTICUT: *Underwood, White;* MASSACHUSETTS: *Underwood, Underwood & Seymour, 941;* NEW JERSEY: *Ellis, White;* PENNSYLVANIA: *Haines, Everhart;* ALABAMA: *Underwood, Earle;* VIRGINIA: *Underwood;* KENTUCKY: *Underwood;* INDIANA, *Underwood;* KANSAS: *Cragin, 490;* OREGON: *Carpenter;* MONTANA: *Reynolds;* COLORADO: *Bethel, Underwood & Selby;* WASHINGTON: *Suksdorf.*

The following is extracted and translated from Tulasne's more extended description of this species: The inner white evanescent pellicle is a remnant of the mucilaginous matter which fills the cup in its early stages. The sporangioles are accumulated in large numbers in a space apparently too small to contain them. They are covered with a thick fibrous coat which can be peeled off, and when deprived of this the sporangiole is black and of a horny consistency. It is composed of two parts, a thick and much interwoven darker outer part, and an inner hyaline portion composed of irregularly shaped filaments taking the place of basidia and forming a hymenium of which the surface is nearly uniform. The rest of the inner substance is composed of the spores without any filaments, which fact distinguishes these sporangioles from some of those belonging to species of *Cyathia*. The funiculus of *Crucibulum* is much more simple than that of *Cyathia hirsuta*, being composed of a little bunch of elastic filaments gathered closely together in a very thin, transparent outer covering, which is hardly noticeable, and of an equal filet, about 2–3 mm. long, which expands itself at the base into the inner wall of the peridium.

III. **Nidula** gen. nov.

Peridium composed of a single homogeneous, but layered membrane which is at first continuous over the mouth much as in *Crucibulum;* sporangioles very numerous, at first immersed in a glutinous substance, very closely packed, entirely filling the central cavity and in no way attached to the peridium wall; no filaments intermixed with the spores.

Peridium shaggy-tomentose; sporangioles light-colored, 2 mm. wide.
1. *N. candida.*

Peridium minutely tomentose; sporangioles dark-colored, barely 1 mm. wide.
2. *N. microcarpa.*

1. **Nidula candida** (Peck)

Nidularia candida Peck, Reg. Rep. **45**: 24. 1891.

Peridia 6–15 mm. high, 6–15 mm. wide at the top, 5–10 mm. at the base, cylindrically cup-shaped, somewhat truncate at the base; outer surface white, becoming dingy with age, thick, felt-like, shaggy-tomentose; inner surface smooth, at first snowy white, becoming brownish with age, somewhat shiny; mouth entire, firm, somewhat spreading but not recurved; sporangioles 1.5–2 mm. in diameter, light grayish fawn-colored, very thin, flattened, both sur-

faces perfectly even, angular, but not depressed; spores 6–10 μ long, 4–8 μ wide, globose to elliptic, hyaline, somewhat granular, thin-walled. (*Pl. 16. f. 17–20.*)

Growing singly on twigs, moss, etc.

WASHINGTON: Olympia, *Henderson, Suksdorf.*

BRITISH COLUMBIA: *Macoun, 107.*

2. **Nidula microcarpa** Peck, sp. nov.

Peridia 4–6 mm. high, 4–5 mm. wide at the top, 3–5 at the base, subcylindrical; outer surface whitish, or pale grayish-yellow, minutely tomentose, firm; inner surface smooth, with a thin brownish shiny layer formed by the drying of the glutinous inner substance; mouth entire, straight and firm; sporangioles very numerous, lenticular, covered with a thick fibrous outer coat, which peels off, as in *Crucibulum crucibuliforme*, when dry rugosely wrinkled, becoming smooth when moistened, reddish-brown, .5–1 mm. wide; spores 6–9 μ long, 4–6 μ wide, broadly elliptic or subglobose, hyaline, thick-walled. (*Pl. 17. f. 1–6; pl. 18. f. 14, 15, 17.*)

Growing on wood, and on the ground.

CALIFORNIA: *W. R. Dudley.*

MONTANA: Columbia Falls, *R. S. Williams.*

2a. NIDULA MICROCARPA **rugispora** var. nov.

Crucibulum rugisporum E. & E. in herb.

Peridia 3–5 mm. high, 3–6 mm. wide at the top; outer surface yellowish-white, with a rather thin close tomentum; inner surface smooth, whitish or brownish, somewhat shiny; mouth recurved, and spreading, and minutely lacerate, fimbriate; sporangioles very numerous, reddish-brown, rugose when dry, barely 1 mm. wide, flattened, subrotund; spores broadly elliptic, hyaline, slightly thick-walled, 6–9 μ long, 4–7 μ wide, slightly larger than in the foregoing species. (*Pl. 17. f. 7–9.*)

Growing on dead twigs.

WASHINGTON: Skamania county, alt. 3,000 ft., *Suksdorf, 510.*

Though this variety closely resembles the species it differs in the mouth characters and in the somewhat larger spores.

IV. GRANULARIA Roth, Ust. Ann. Bot. 1: 6. *pl. 1. f. 1.* 1791

Nidularia Fries & Nord. Symb. Gaster. 2. 1817–18.

Peridium composed of a single homogeneous rather thin closed membrane, or a thin, closely interwoven layer of branched fila-

ments, opening more or less irregularly by the breaking away or falling to pieces of the walls at maturity, having no true epiphragm: sporangioles enveloped in mucus and not attached in any way to the inner surface of the peridium.

The history of the genus *Granularia*, though not as long as that of the first two genera belonging to this family, appears to have become more involved and complicated, very probably owing to the fact that the species of *Granularia* are as a rule, rarer, and less conspicuous than the species of *Cyathia* and *Crucibulum*. Micheli * in 1729 figured "*Cyathoides scutellatum*," which is unquestionably a true *Granularia*, and the reason why this species has since been placed under *Cyathus* by Roth † and later by Tulasne, it hard to understand. Micheli, in writing of this genus, says "[fructus] vel prope centrum, vel ad circumferentiam brevissimo pediculo seu umbilicali funicolo firmantur," but of the figure of three sporangioles of "*Cyathoides scutellatum*" only one has a short lateral attachment, and that much shorter than in the figures of the sporangioles of the three other species represented. Fries ‡ says of his second division, which contains true *Granularia*, that the sporangioles have no umbilicus or umbilical thread, but are attached by the margin. Tulasne writes that notwithstanding these authorities, the lateral position of a funiculus seems very problematical in the genus *Cyathia*, and that the sporangioles of the specimens of *Granularia* which he has studied do not adhere any more by the edge than by any other point, either to the mucilage in which they are immersed or to the peridium. This idea must have arisen from the fact that the mucus contiguous to the walls of the peridium dries up a little quicker than that in the center of the cup and for this reason, several sporangioles appear to be fixed by their outer margin, while they are still loose in the center of the cup. But this does not explain why "*scutellaris*" has been made a species of *Cyathia*.

No other writer seems to have mentioned this plant after Micheli until 1791, when Roth described a new genus *Granularia*, as follows: "Fungus subrotundus, granis mucilagine immersis

* Nov. Pl. Gen. 222. *pl. 102. f. 4.* 1729.
† Roth, Cat. Bot. 1: 237. 1797.
‡ Syst. Myc. 2: 300. 1822.

farctus," with one species *Granularia pisiformis*, which he fully describes and figures. This is unquestionably a *Nidularia*, as this genus was called until Otto Kuntze restored *Granularia* to its proper place in 1891. Roth* himself described and figured two species six years later under the name of *Cyathus farctus*, and *Cyathus scutellaris;* it is possible that these belong to our genus *Nidula*, but with the imperfect descriptions it is difficult to determine. It is very evident that they are not species of *Cyathia*.

Bulliard,† in 1780 made the first mention of the name *Nidularia*, but he referred it to figures which have been unquestionably proved to be *Cyathia lentifera* and *Crucibulum crucibuliforme*. Sibthorp‡ also employed this name for *Cyathia lentifera*, *Cyathia hirsuta* and *Crucibulum crucibuliforme*. In 1817 Nees‡ described and figured *Nidularia granulifera*, but although he gives a colored plate, it is difficult to form a correct idea of his plant. Two years later Ehrenberg‖ described and figured *Nidularia globosa* which he says resembles *Cyathus farctus* Roth and *Cyathus deformis* Willd.¶ but agrees with neither. About this time, 1818, Schweinitz described from North Carolina *Cyathus pulvinatus*, which, though unfortunately none of the original material remains except some of the wood on which it grew, is evidently a true *Granularia* and is a fairly common species in our own country, and the only clear and definite one of the whole tangled thread of the present history.

The family Nidulariaceae was established by Fries in 1822. Under the section "*Nidularia*," he gives seven species, five of which are the above-quoted ones of Nees, Schweinitz, Roth, Ehrenberg and Willdenow; the last one, *Nidularia denudata* Fr. & Nordh.** appears from the description to be a true *Granularia*, while the third species which he gives as *Nidularia farcta* he refers to Ray's†† no. 21, which is the first mention of *Crucibulum cruciburiforme*.

---

* Cat. Bot. 1: 237. *pl. 7. f. 2.* 1797.
† Herb. Fr. *pl. 488.*
‡ Flor. Ox. 393. 1794.
§ Syst. Pilze. 139 note. *pl. 13. f. 133c.* 1817.
‖ Sylv. Myc. Berol. 16, 28. *f. 8.* 1819.
¶ Ust. Bot. Mag. 2: 14. *pl. 3. f. 8.* 1788.
** Symb. Gaster. 4. 1817–18.
†† Syn. 20. *pl. 1. f. 2.*

Fischer * in writing of *Nidularia* says that there are sixteen known species, but though De Toni † gives eighteen from all parts of the world, it is more than probable that several of these are either synonyms of other species or belong to other genera. Tulasne gives eleven species, to nine of which he adds "non vidimus"! the remaining two being new species—*Nidularia australis* from Chili, South America, and *Nidularia Duriaeana* from LaCalle, Algeria (Mauritania). From America several additional species have been described, namely, *Nidularia Alabamensis* Atk. ‡ from Alabama, which we have reduced to *Granularia pulvinata*, and *Nidularia rubella* E. & E. § from New Jersey. This last species is very uncertain, in fact it may not belong to this family at all, as the sporangioles are quite different in texture from those of all the other species, and have never been found to contain any spores, being filled with small pieces of amorphous hyaline matter. It is hard to believe that the plants are in an immature condition as the peridial walls have in some specimens almost entirely disappeared. The only remaining species of *Nidularia* which has been described in this country is *Nidularia candida* Peck which has been referred to the preceding genus. Two heretofore unpublished species of *Granularia* complete our present list: *Granularia castanea*, a herbarium species of Ellis & Everhart, under the name of *Nidularia castanea*, from New Jersey found in 1883, and *Granularia rudis* Peck, from California.

Synopsis of the Species of Granularia

Sporangioles numerous, small (1 mm. or less in diameter).	
Peridium tubercular, pulverulent.	1. *G. pulvinata.*
Peridium only slightly tubercular, not pulverulent.	2. *G. castanea.*
Sporangioles few, larger (2 mm. or more in diameter).	3. *G. rudis.*

1. GRANULARIA PULVINATA (Schwein.) Kuntze, Rev. Gen. Pl. **2**: 855. 1891

Cyathus pulvinatus Schwein. Fung. Car. Sup. 51. 1818.

Nidularia pulvinata Fries, Syst. Myc. **2**: 301. 1822; Schwein. Trans. Am. Phil. Soc. **4**: 253. 1834.

* Engler & Prantl. Nat. Pflanzenfam. 1^{1**}: 326. 1899.

† Saccardo. Syll. Fung. **7**: 28. 1888;—**9**: 265. 1891;—**11**: 156. 1895;—**14**: 256. 1899.

‡ Bull. Cornell Univ. (Science) **3**: 23. 1897.

§ Bull. Torrey Club, **11**: 18. 1884.

Nidularia Alabamensis Atk. Bull. Cornell Univ. (Science) **3**: 23. 1897.

Peridia subspherical, sessile, 2–10 mm. wide, 2–9 mm. high, reddish-brown or dirty cinnamon-colored, at first very floccose-pulverulent, gradually becoming smoother with age, dehiscing irregularly or not at all; peridium thin and rather brittle, tuberculose; inner surface is shiny, smooth, brownish; sporangioles very numerous, darkish brown, barely 1 mm. in diameter, somewhat angular and depressed; spores hyaline, thick-walled, 6–10 μ long, 4–7 μ wide. (*Pl. 17. f. 10–16, 20; Pl. 18. f. 19.*)

Plants gregarious, rarely singly on wood.

NEW YORK: *Ellis, Fairman, Kupfer*; LOUISIANA: *Langlois*, 2666 and 1821; CONNECTICUT: *White*; MAINE: *Harvey*; ALABAMA: Auburn, *Atkinson.*

The floccose pulverulent appearance of the surface of the peridium is caused by the innumerable ends of the filaments which compose the peridium protruding above the main structure, soon becoming broken or eroded. This is a very characteristic feature which renders this species easily recognizable.

Atkinson (*l. c.*) describes *Nidularia Alabamensis*, which undoubtedly belongs here substantially as follows: Peridia spherical, sessile, reddish-brown, roughened, 4–5 mm. in diameter, irregularly dehiscing by the breaking into fragments of the upper portion exposing the sporangioles which completely fill it; no "rooting" threads; sporangioles lenticular, shiny, dark or blackish-brown, barely 1 mm. in diameter, corrugated, hard, filled with a whitish pulpy material which is composed of stout irregular flexous or blanched knotty strongly tuberculose threads with which the spores are mixed; the spores are obovately hyaline, 4–6 × 3–4 μ.

On decaying wood.

ALABAMA: Auburn, July, 1890.

2. **Granularia castanea** (Ell. & Ev.) sp. nov.

Nidularia castanea Ellis & Everhart in herb.

Peridia small, elongate-globose, or subspherical, sessile, sometimes confluent, .5–2 mm. long, 0.5–1 mm. high; peridial walls very thin, and brittle at first, pale yellowish fawn-colored, gradually as the plant matures becoming grayish, and somewhat tuberculose from the inner pressure of the sporangioles, dehiscing irregularly, the outer covering often breaking away completely,

leaving the sporangioles seated alone on the wood, barely visible without magnification; sporangioles yellowish-brown, very numerous, crowded, circular, flattened above and below, barely 0.25 mm. in diameter, even or slightly creased under high magnification; spores subglobose, hyaline, thick-walled, 4–7 μ long, 3–6 μ wide. (*Pl. 17. f. 17–19; pl. 18. f. 20.*)

Gregarious on wood.

NEW JERSEY: Newfield, July, 1883. *Ellis.*

3. **Granularia rudis** Peck sp. nov.

Peridia hemispherical or subglobose, sessile; outer covering thin, smooth, fragile when dry, cellular, rather gelatinous when moist, yellowish-brown with a faint greenish tint; indehiscent or the peridial walls gradually breaking away; sporangioles few, irregular, angular or compressed, 2–2.3 mm. in diameter, blackish or greenish tinted; spores broadly elliptic or subglobose, hyaline, 7–9 μ long, 6–8 μ broad. (*Pl. 17. f. 21–23.*)

On decaying wood.

CALIFORNIA: *W. R. Dudley.*

The material from which this species is described is very scanty, but the specific features are so individual, and they differ so much from any known species of *Granularia* that it has been decided to include it in the present revision. It differs from all known species in the gelatinous cellular and greenish texture of the peridium, and in the large angular sporangioles, only a few being contained in each peridium.

SPECIES INQUIRENDA

NIDULARIA RUBELLA Ell. & Everh. Bull. Torrey Club, **11**: 18. 1884.

The following table will show the present known distribution of the family in North America:

	Cyathia dura.	*C. lentifera.*	*C. limbata.*	*C. intermedia.*	*C. melanosperma.*	*C. Berkleyana.*	*C. Montagnei.*	*C. pallida.*	*C. Poeppigii.*	*C. rueisperma.*	*C. rufipes.*	*C. stercorea.*	*C. striata.*	*C. Wrightii.*	*Crucibulum crucibuliforme.*	*Nidula candida.*	*N. microcarpa.*	*Granularia pubinnata.*	*G. castanea.*	*G. rudis.*
Canada.												++								
Maine.		+										++			+			+		
Massachusetts.												+			+					
Connecticut.		+										++			++			+		
New York.		+										++			+			+		
New Jersey.												+			+				+	
Pennsylvania.		+		+					+			++			+					
Delaware.				+								+								
Virginia.												+			+					
South Carolina.												+			+					
Georgia.												+								
Alabama.		+										++			+			+		
Louisiana.												+						+		
Ohio.												++								
Indiana.		+										++			+					
Kentucky.															+					
Wisconsin.												+								
Iowa.												++								
Nebraska.												++								
Kansas.		+										++			+					
Texas.		+																		
New Mexico.												+								
Colorado.		++										++			+					
Utah.		+																		
Montana.												+			+			+		
Washington.												+			++					
Oregon.															+					
California.		+																+		+
British Columbia.				+											+					
Cuba.			+		+	+	+	+				+	+							
Puerto Rico.		+								+										
St. Croix.											+									
Jamaica.					+								+							
Mexico.						+														

Explanation of Plates

The figures on Plates 14, 15, 16 and 17 were drawn one quarter larger than indicated. Those on Plate 18 were made twice the size. The microscopic details were drawn with a camera lucida and reduced on the same scale, as above noted.

PLATE 14

FIG. 1. *Cyathia Poeppigii*, nat. size. 2. The same, enlarged about three times after moistening. 3. Single peridium in dry condition. 4. Spores, × 335. 5. *Cyathia Berkleyana*, nat. size. 6. Peridium of same, enlarged three times. 7. Spores, × 335. 8. *Cyathia intermedia*, nat. size. 9. Peridia, enlarged twice, one in dry condition, the other after expanding when moistened. 10. Spores, × 335. 11. *Cyathia hirsuta* nat. size. 12. Group, enlarged about three times. 13. Spores, × 335. 14, 15. *Cyathia hirsuta infundibuliformis*, enlarged about three times. 16. *Cyathia dura*, nat. size. 17, 18. Peridia, enlarged twice. 19. Spores, × 335. 20. *Cyathia Montagnei*, nat. size. 21. Peridium, enlarged twice. 22. Spores, × 335.

PLATE 15

FIG. 1. *Cyathia melanosperma*, nat. size. 2. Single peridium, nat. size (after moistening). 3. Single peridium, enlarged about three times. 4. Spores, × 335. 5. *Cyathia pallida*, nat. size. 6. Mature and young peridia, enlarged twice. 7. Spores, × 335. 8. *Cyathia lentifera*, nat. size. 9, 10, 11, 12. Different specimens showing character of growth and shape, enlarged twice. 13. Spores, × 335. 14 *Cyathia rufipes*, nat. size. 15. Peridia, enlarged twice. 16. Spores, × 335. 17. *Cyathia stercorea*, nat. size. 18, 19. Different specimens showing character of growth and shape, enlarged about three times. 20. Spores, × 335.

PLATE 16

FIGS. 1, 2. *Cyathia stercorea*, showing additional types and characteristics, enlarged twice. 3. *Cyathia rugisperma*, natural size. 4. Peridia enlarged twice. 5. Spores, × 335. 6. Spores, × 585. 7. *Cyathia Wrightii*, natural size. 8, 9. Peridia, enlarged twice. 10. *Crucibulum crucibuliforme*, natural size. 11. Section of sporangiole, × 50. 12. Group of peridia, enlarged twice. 13. Spores, × 335. 14. Group of peridia from the Schweinitz specimens of *Crucibulum juglandicolum*. 15. Spores from the same, × 335. 16. *Cyathia* (?) sp., natural size. 17. *Nidula candida*, natural size. 18, 19. Peridia, somewhat enlarged. 20. Spores and filament, × 335. 21, 22. Spores of *Cyathia* (?) sp., × 335.

PLATE 17

FIG. 1. *Nidula microcarpa*, nat. size. 2. Peridia, enlarged twice. 3. Section enlarged about five times. 4. Sporangiole showing torn outer covering, enlarged about twenty-five times. 5. Sporangiole still in its outer covering, enlarged twelve times. 6. Spores, × 335. 7. *Nidula microcarpa rugispora*, nat. size. 8. Peridium, enlarged three times. 9. Spores, × 335. 10. *Granularia pulvinata*, nat. size, reduced from drawing by Mr. Hasselbring of *Nidularia Alabamensis* Atk. 11. *Granularia pulvinata*, nat. size. 12. Peridia, enlarged three times. 13. Spores and filaments, × 335. 14. Very old peridia, the walls of which have almost completely fallen away. 15. Spores. × 585. 16. Spores, × 335. 17. *Granularia castanea*, nat. size. 18. Group of peridia, enlarged twice. 19. Irregular peridia, having grown together, enlarged twice, 20. Spores of *Granularia pulvinata*, × 335 (*Nidularia Alabamensis* Atk.). 21. *Granularia rudis*, enlarged twice. 22. Spores, × 335. 23. Sporangioles, × 15.

PLATE 18

FIGS. 1–6. *Cyathia hirsuta*. 1. Sporangiole, showing attachment, enlarged about fifteen times. 2. Spore, × 390. 3. Spores and filaments, × 215. 4. Threads of outer coating of sporangiole, × 215. 5. Nodose filaments of the funiculus, × 390. 6. Portion of the funiculus, × 110. 7–13. *Crucibulum crucibuliforme*. 7. Sporangiole, × 15. 8. Sporangiole, with the outer coat peeling off. 9. Small portion of a section of a sporangiole, × 215. 10, 11. Spores of young specimen, × 390. 12. Spores of fully mature specimen, showing contraction of inner substance, × 390. 13. Small portion of the ends of the filaments of the thin membrane covering the mouth of the immature specimen, × 315. 14. Spores of *Nidula microcarpa*, × 390. 15. Lateral portion of outer coat of the sporangioles of same, × 215. 16. Small portion of the outer coat of the sporangiole of *Crucibulum crucibuliforme*, × 215. 17. Section of a sporangiole of *Nidula microcarpa*, × 110. 18. Fascicular hairs from the outer covering of the peridium of *Cyathia intermedia*, × 15. 19. Small portion of the peridial wall of *Granularia pulvinata*, × 215. 20. Sporangioles of *Granularia castanea*, when devoid of peridial covering, × 110.

Notes on American Hepaticae

By Marshall A. Howe

I. Cephalozia connivens

Cephalozia connivens (Dicks.) Lindb. Proc. Linn. Soc. **13**: 190. 1872. Kritisk Gransk. Mossorna Dill. Hist. Musc. 38. 1883. Spruce, On Cephalozia, 46. 1882. Lindb. & Arn. Sv. Vet.-Akad. Handl. **23**[5]: 20. 1889. Kaalaas, Nyt Mag. 165. 1893.

Jungermannia connivens Dicks. Fasc. Pl. Crypt. Brit. **4**: 19. *pl. 11. f. 15.* 1801.

Cephalozia multiflora Lindb. Act. Soc. Sci. Fenn. **10**: 501. 1875. Musc. Scand. 4. 1879.

This species has been much confused with its near relative *Cephalozia lunulaefolia* Dumort. (*C. media* Lindb., *C. multiflora* Spruce) both in Europe and America, but is very distinct as was first well pointed out by Spruce (*On Cephalozia*, 39. 1882). The plant may be readily distinguished from *C. lunulaefolia* by the large leaf-cells (35–90 μ, while only 25–50 μ in *C. lunulaefolia*), by the long-ciliate perianth-mouth, by the perianth-wall being unistratose throughout, and by being autoicous. The specimens distributed by Sullivant under the name of *Jungermannia connivens* in Musci Alleghanienses (no. 246) belong with *C. lunulaefolia* so far as we have been able to see them, and the same is true of no. 57 of Austin's Hepaticae Boreali-Americanae, issued as *Cephalozia connivens*. In 1896, Professor Underwood, in his review of "The Genus *Cephalozia* in North America" (Bull. Torrey Club, **23**: 381–394), placed *Cephalozia connivens* under "Species dubiae et inquirendae," remarking that it was likely to occur northward. In October, 1898, the writer of the present notes announced * at a meeting of the Torrey Botanical Club the discovery of the genuine *Cephalozia connivens* on the grounds of the New York Botanical Garden, supposing this to be the first collection of the real *C. connivens* in America. The species was soon found in several other places in the neighborhood of New York, and this has led to an

* Bull. Torrey Club, **26**: 24. 1899.

examination of the specimens of *Cephalozia* in the accessible herbaria with the result that we are now able to cite seventeen North American specimens of the true *Cephalozia connivens*, showing a coastwise range from Prince Edward Island to Florida, and an extension inland as far as London, Ontario.

The specimens cited may be arranged as follows:

PRINCE EDWARD ISLAND: *J. Macoun*, June 27, 1888, no. 139 (a little only, mixed with *C. lunulaefolia* and *Kantia trichomanis*). ONTARIO: London, *J. Dearness* (in herb. Underwood, comm. in 1889 as no. 1). RHODE ISLAND: Providence, from Olney collection in Chapman herbarium; also, in same herbarium, a second specimen from Rhode Island, without locality. CONNECTICUT: on the ground in wet woods, Westville, *A. W. Evans*, November 29, 1890. NEW YORK: in a tamarack swamp, Syracuse, *L. M. Underwood*, April, 1888; Staten Island, *Mrs. E. G. Britton*, February 14, 1892; on the top of a decayed hemlock stump near Bronx River, New York Botanical Garden, *M. A. Howe*, September 21, 1898, with *Odontoschisma sphagni;* on bank of a stream in a boggy wood, Freeport, Long Island, *M. A. Howe*, October 17, 1898; on margin of a swamp, Richmond, Staten Island, *M. A. Howe*, October 23, 1898; Sayville, Long Island, *F. E. Lloyd*, March 5, 1899. DELAWARE: on ground in woods, Wilmington, *A. Commons*, March 12, 1890; in herb. Columbia University. NORTH CAROLINA: Salem, *Schweinitz*, in herb. Torrey (labelled *Jungermannia bicornis* by Schweinitz). SOUTH CAROLINA: Summerville, *C. G. Dubois*, April, 1889. FLORIDA: Lisbon, *L. M. Underwood*, January, 1891 (distributed from U. S. National Herbarium as no. 1217); Port Orange, *F. C. Straub*, February 23, 1895 (no. 207 in herb. Underwood)—also in same locality, March, 1895, mixed with *Telaranea* and a minute *Lepidozia* in Hepaticae Americanae, no. 180. BERMUDA: Devonshire Marsh, *M. A. Howe*, July 4, 1900.

Lindberg appears to have been the first to have combined the specific name *connivens* (Dicks.) with the generic name *Cephalozia*, although at the outset he attributed the binomial to Dumortier. Dumortier however persisted even in his "Hepaticae Europae" in keeping the species under *Blepharostoma* and seems never to have written *Cephalozia connivens*. The synonymy of the species is

confused, owing partly to the fact that is was not until 1881 and 1882 that Lindberg and Spruce began to distinguish, in their published works at least, between the true *Cephalozia connivens* and *C. lunulaefolia*, and owing furthermore to some uncertainties attending the determination of *Jungermannia multiflora* of Hudson (Fl. Angl. 431. 1762). The question of interpreting correctly Hudson's *J. multiflora*, difficult at best, is needlessly complicated by Dr. Spruce (*l. c.* 40) by quoting the 1778 edition of Hudson's Flora Anglica, where a supposed synonym from Linné's Mantissa is introduced, though the original 1762 edition without the Linnaean synonym is all that needs to be considered. The original *Jungermannia multiflora* seems to have been founded wholly upon a plant described and figured by Dillenius (Hist. Musc. 481. *pl. 69. f. 4.* 1741). As noted already by Hooker, Spruce, and Lindberg, the figures given by Dillenius point strongly to *Cephalozia bicuspidata*. It is quite impossible to believe that they were drawn from specimens of *C. connivens* and Dillen's words "*per lentem vero perangusta*" in describing the leaves could not well apply to this species, yet Lindberg in 1875 (Act. Soc. Sci. Fenn. **10**: 501), after determining the specimen in the Dillenean herbarium bearing the corresponding name and number from the Historia Muscorum to be the *Jungermannia connivens* * of Dickson, brought forward for this species Hudson's name *multiflora*. Finally,† however, interpreting this "Lichenastrum multiflorum exile foliis angustissimis" of Dillenius by the figure and description, Lindberg considers it a synonym of *Cephalozia bicuspidata* (L.) Dumort., which seems to us the most reasonable course in the matter. Lindberg at the same time most unwarrantably interprets *Jungermannia multiflora* Huds. in the light of additions made by Linnaeus nine years after its original publication and shifts the specific name *multiflora* to *Lepidozia setacea* (Web.) Mitt. It is clear that if *Jungermannia multiflora* Huds. (1762) can be justly treated as a synonym of *J. bicuspidata* L. (1753) it should always remain a "dead name."

* This determination, it may be noted, was made several years before the distinctions between the true *C. connivens* and *C. lunulaefolia* (*C. media* Lindb.) were recognized in print, at least, yet the statement that the Dillenian specimen is "*C. connivens* (Dicks.) Lindb.," was repeated by Lindberg in 1883, two years after his publication of *C. media*.

† Kritisk Gransk. Mossorna Dill. Hist. Musc. 38. 1883.

II. TELARANEA

TELARANEA Spruce, Trans. and Proc. Bot. Soc. [Edinb.] **15**: 365. 1885. [As a synonym.] Schiffn.; Engl. & Prantl, Nat. Pflanzenfam. **I**^{3}: 103. 1895.

The genus *Telaranea* has points of contact with *Lepidozia*, *Blepharostoma*, and *Arachniopsis*, and if generic rank is denied to it, might be incorporated with any one of the three with almost equal justice. To the *Micro-Lepidozia* section of the genus *Lepidozia* its affinity is perhaps especially close, yet, according to prevailing conceptions of genera among the Hepaticae, it seems a rather violent proceeding to include it in a generic group the historical type of which is *Jungermannia reptans* L. *Telaranea* diverges from *Lepidozia* in its delicate, filmy, conferva-like habit and in the division of the leaves very nearly or quite to the base, the segments being never more highly connate than through half the altitude of the basal cell and usually for a considerably less distance; the leaf-segments are capillary, of a single row of cells unless at the very base, the place of the basal cell being often occupied by a pair of cells side by side. From *Blepharostoma*, *Telaranea* is probably best distinguished by the disparity in size between leaves and underleaves and by the more pinnate branching. The archegonia, though usually borne on short postical branches as in *Lepidozia* and *Cephalozia*, are sometimes terminal on the main stem or lateral branches as in *Blepharostoma*.

In its filmy habit and delicacy of structure *Telaranea* is suggestive of *Arachniopsis* Spruce, but the latter genus represents a still further departure along the same lines from the *Lepidozia* type. In *Arachniopsis* the branches are all postical in origin, the underleaves are entirely wanting or are now and then to be recognized only in a most rudimentary form, and the leaves never have more than two segments which are wholly free at the base and consist of a single series of cells throughout.

The species and varieties to be arranged under the genus are, so far as we know them, as follows:

1. **Telaranea nematodes** (Gottsche)

Jungermannia nematodes Gottsche, Hepaticae Cubenses Wrightianae.

Cephalozia nematodes Aust. Bull. Torrey Club, **6**: 302. 1879.

Lepidozia chaetophylla Spruce, Trans. and Proc. Bot. Soc. [Edinb.] **15**: 365. 1885.

Lepidozia nematodes Spruce, *l. c.* 366.

Telaranea chaetophylla Spruce, "Mst. nov. gen." *l. c.* [as synonym]. Schiffn.; Engl. & Prantl, Nat. Pflanzenfam. **1**[3]: 103. 1895.

Lepidozia chaetophylla tenuis Pearson, Christ. Vid.-Selsk. Forhandl. 1886[3]: 9. 1886. Evans, Bull. Torrey Club, **20**: 308. 1893.

Blepharostoma nematodes Underw. Bull. Torrey Club, **23**: 383 (footnote). 1896.

Spruce in comparing his *Lepidozia chaetophylla* with *Lepidozia nematodes* (Gottsche) emphasizes the flaccidity of the latter as a distinguishing character and this indeed appears to be about the only difference of importance to be detected between Wright's Cuban plant and those from South America distributed by Spruce as *Telaranea chaetophylla* (Hepaticae Spruceanae: Amazonicae et Andinae). Wright's specimens revive quite imperfectly on being soaked out with water, but there is such a range of variability in this respect in different parts of a single tuft and even of different parts of a single plant, both in the Cuban and South American specimens that we are not inclined to give much weight to this character. We therefore agree with our friend Mr. Pearson (*l. c.*) in believing that the two forms represent a single species. We would, however, differ from Pearson in retaining for this species the oldest published name *nematodes*. The specific name *nemoides* given earlier by Taylor to another plant now recognized as a *Lepidozia* seems sufficiently different both to the eye and ear to prevent confusion.*

In both the Cuban and South American plants the archegonia are usually borne on a short postical branch, rarely at the end of the main axis or of an elongated branch. In 1886, Pearson (*l. c.*) identified a specimen from Natal, South Africa, with Gottsche's Cuban species, which he renamed *Lepidozia chaetophylla tenuis*.

*The remark is attributed to Spruce (Pearson, *l. c.*) that *nemoides* and *nematodes* differ only in case-ending. It seems to us that the two words are equally nominative in form but that Taylor's name *nemoides* is an etymological monstrosity on account of his failure to use the true stem of the Greek noun in constructing the adjective.

Through the courtesy of Mr. Pearson we have been able to examine this South African plant, and like him, can find no reasonable grounds for distinguishing it from the American specimens alluded to. *Telaranea nematodes*, then, may be said to be found in a fairly typical condition in South America and South Africa as well as in Cuba, and to this range is now to be added Bermuda, where sterile plants were collected by the writer in Devonshire Marsh, July 4, 1900, growing in company with *Cephalozia connivens* and *C. divaricata*. In addition to this more or less typical form, illustrated by the specimens and descriptions cited, the species presents itself also in two forms which we think are sufficiently marked to receive varietal names. These are:

1a. **Telaranea nematodes Antillanum** (Besch. & Spruce)

Blepharostoma Antillanum Besch. & Spruce, Bull. Soc. Bot. France, **36**: clxxxiii. 1889.

Archegonia terminal on main stem, a lateral branch, or elongated postical branch, rarely on a short postical branch; leaves and perianth rather rigid.

Le Gommier, Gaudeloupe, *Ed. Marie*. In a specimen of the Guadeloupe plant kindly communicated by M. Bescherelle we find on a single individual all the various modes of bearing archegonia described above. The leaves, described by the authors as 4-parted, we find much more frequently 3- and 2-parted. It seems as impossible to separate this plant specifically from *Lepidozia chaetophylla* Spruce as it is to distinguish satisfactorily between the latter and Gottsche's *Jungermannia nematodes*. So far as we know, the identification of *Blepharostoma Antillanum* with *Jungermannia nematodes* was first made by Professor Schiffner (Engl. & Prantl, Nat. Pflanzenfam. **1**[3]: 105. 1895).

1b. **Telaranea nematodes longifolia** var. nov.

Leaves more rigid than in type and more widely spaced, 0.4–0.8 (rarely 0.9 mm.) long, leaf-cells 2–4½ times as long as broad.

Collected by the writer on humus in a swampy wood in company with *Sphagnum*, *Pallavicinia Lyellii*, and *Cephalozia catenulata*, Freeport,* Long Island, New York, October 17, 1898

* This Freeport plant was listed by Dr. Smith Ely Jelliffe in his Flora of Long Island (48. 1899) under the name *Blepharostoma nematodes*.

(type specimen in herb. N. Y. Botanical Garden). Also, Florida, *John Donnell Smith*, 1877; *C. F. Austin*, March, 1878; *F. C. Straub*, March, 1895; Brunswick, Georgia, *C. F. Austin*, April, 1878.

The Long Island specimens agree essentially with those from Georgia and Florida, though the latter make a slightly closer approach to the Cuban plant. The Long Island station is therefore a noteworthy northward extension of the known range of a plant which has heretofore figured in papers on North American Hepaticae as coming only from a limited region of the South. The archegonia in these United States specimens, so far as we have observed, always occur on a short postical branch. The leaves are 5–8 cells long; the underleaves are 3- or 2-parted, their prongs of 2 or 3 cells each, incurved at the apices. All are autoicous. In the original *Jungermannia nematodes*, collected in Cuba by Wright, the leaves are 0.25–0.5 mm. long, 4–6 cells high, the cells being 2–3 times longer than broad.

The variety *longifolia* often gives the impression of being two or three times the size of the Cuban plant, but we have been unable to find any reliable structural characters to serve for a specific separation. The form of the perianth seems quite variable in all conditions of the species, but is often broader in the var. *longifolia* than in the type.

No. 180 Hep. Am., issued as *Blepharostoma nematodes*, is referable to *Telaranea nematodes longifolia;* it is mixed with *Cephalozia connivens* and with a minute *Lepidozia*, probably a reduced form of *L. setacea*.

Telaranea bicruris (Steph.)

Lepidozia bicruris Steph. Hedwigia, **24**: 166. *pl. 3*. 1885.

BRAZIL: São Francisco, *Ule*.

This plant, though a close relative of *T. nematodes*, seems entitled to specific distinction, differing in the almost invariably 2-parted leaves, in the frequent continuation of the stems into leafless flagella (rare in *T. nematodes*) and in the simpler ♀ bracts. It is described by Stephani as dioicous, though apparently he had not seen ♂ plants. We have been unsuccessful in attempts to find antheridia in the specimen kindly communicated by Herr Stephani, and it certainly may be suspected that dioicism is to be

added to its distinguishing characters. All the perianths seen are on very short postical branches.

III. ARACHNIOPSIS

Arachniopsis diacantha (Mont.)

Jungermannia diacantha Mont. Ann. Sci. Nat. IV. **5**: 349. 1856.

Arachniopsis coactilis capillacea Spruce, On Cephalozia, 85. 1882; Trans. and Proc. Bot. Soc. [Edinb.] **15**: 356. 1885.

Leaves mostly rigid, composed of 4–6 cells, these 4–7 times as long as broad.

PERU: *Weddell, Spruce.*

Jungermannia diacantha Mont. is represented in the Montagne herbarium, now preserved in the Muséum d'Histoire Naturelle of Paris, only by two small sterile fragments fastened to pieces of mica. This original material, which we have seen through the courtesy of Mons. Hariot, agrees perfectly, so far as it goes, with the specimen from Mt. Campana, Peruvian Andes, distributed by Spruce as *Arachniopsis capillacea* in his "Hepaticae Spruceanae: Amazonicae et Andinae." Montagne's description of the leaves as "spiraliter 5/1 circa caulem dispositis" was evidently an error, due, it may be, to a torsion of the stem.

Arachniopsis confervifolia (Gottsche).

Jungermannia confervifolia Gottsche, Hepaticae Cubenses Wrightianae.

Cephalozia confervifolia Aust. Bull. Torrey Club, **6**: 302. 1879.

Arachniopsis coactilis Spruce, On Cephalozia, 85. 1882. Trans. and Proc. Bot. Soc. [Edinb.] **15**: 355. *pl. 13.* 1885. Excluding var. *capillacea.*

Leaves often flaccid, composed of 6–14 cells, these 2–3 times as long as broad.

CUBA: *Wright;* SOUTH AMERICA: on the tributaries of the Amazon, *Spruce.* We have little hesitancy in considering *Arachniopsis coactilis* Spruce a synonym of the Cuban *Jungermannia confervifolia* Gottsche. The latter is more flaccid, showing a relation to the South American specimens somewhat analogous to that

described above as existing between *Jungermannia nematodes* Gottsche and *Lepidozia chaetophylla* Spruce. The Cuban plant is autoicous and in structural characters is essentially identical with the typical *A. coactilis*. Vestiges of underleaves are occasionally met with in both and in both the leaf is sometimes reduced to a single prong.

The specific separation of *Arachniopsis confervifolia* from *A. diacantha* is possibly open to question, yet in the light of available specimens the two appear distinct. *Arachniopsis coactilis filifolia* Spruce, judging from specimens distributed as *Arachniopsis filifolia* in Hepaticae Spruceanae, seems to us less entitled to specific rank.

Arachniopsis confervifolia resembles *Telaranea nematodes* in outward appearance, but is easily distinguished by the characters alluded to above under *Telaranea*. It is to be expected that *Arachniopsis* will be found to occur within the limits of the United States.

IV. RICCIA CAMPBELLIANA

Herr M. Heeg, of Vienna, has kindly called our attention (*in litt.*) to the close resemblance between the Californian *Riccia Campbelliana* M. A. Howe (Mem. Torrey Club, **7**: 26. *pl. 91. f. 1–15*. 1899) and the Mediterranean *Riccia macrocarpa* Levier (Bull. Soc. Bot. Ital. 1894: 114. 1894). The similarity is indeed very striking as is evident from specimens of *R. macrocarpa* which we owe to Dr. Levier, but *R. macrocarpa* appears to be uniformly dioicous as originally described by Levier and as described again by Stephani (Bull. Herb. Boiss. **6**: 343. 1898), while *R. Campbelliana* is uniformly monoicous; and the areolae of the outer face of the spores of *Riccia macrocarpa* are more perfect than in *R. Campbelliana*. In view of these differences the claim of *Riccia Campbelliana* to specific rank seems defensible for the present at least. The species has recently been collected by Dr. Walter R. Shaw at Claremont, Los Angeles County, Cal., thus extending its known range about two hundred and fifty miles southward.

Concerning some West American Fungi

By David Griffiths

This writing is intended to supplement the information supplied on some conventional herbarium labels recently distributed, and to call attention more in detail to certain species which appear to the author to have hitherto escaped the attention of mycologists. All species described are being liberally distributed so that the determinations may be easily verified.

Tilletia externa sp. nov.

Fructification of fungus occurring between the seed coats of the ovary where a black powdery mass of spores is formed surrounding the entire ovary, in some cases, but always more abundantly developed on the upper half, and often not appearing on the lower half at all. Spores black in mass, dark fuscous when viewed singly by transmitted light, very variable in size and shape, subglobose to elliptical, or irregular and angular, 10–13 μ × 18–23 μ or the subglobose spores 17–21 μ in diameter, the contents granular; epispore thin, smooth, surrounded by a hyaline envelope 2–2½ μ in thickness. (Fig. 1.)

Affecting ovaries of *Carex filifolia* Nutt. (305)* on Burnett's Ranch near Buffalo, Wyo., Aug. 1898 (Williams & Griffiths). The fungus was especially abundant and destructive in this locality on high dry knolls at an altitude of about 4000 feet.

Tilletia Earlei sp. nov.

Fungus producing its spores usually in the next to the upper internode of the culm, transforming the parenchymatous tissue within and between the vascular bundles into a light brown powdery mass of spores which finally ruptures the tissue between the bundles producing long fissures a centimeter to a decimeter in length, the edges of the fissure recurving so as to expose and distribute the mass of spores; culms usually much swollen and otherwise distorted and separated from the sheath. Spores light brown in mass but only very slightly tinted when viewed singly, globose, evenly covered with very coarse tubercles and surrounded

* All figures used in this manner refer to the serial numbers of West American Fungi.

by a hyaline envelope about 2 μ thick; epispore rather thin but often appearing thick on account of the tubercles, 13–18 μ in diameter. (Fig. 2.)

Affecting the culms of *Agropyron occidentale* Scribn. (311), Aberdeen, S. D., August 10, 1896. The host grew on ground heavily fertilized with refuse from the city on high and dry banks of the Moccasin a short distance below the mouth of a sewer. The species is easily recognized by its method of attack as well as by its color which is more like that of some of the species of *Soro-*

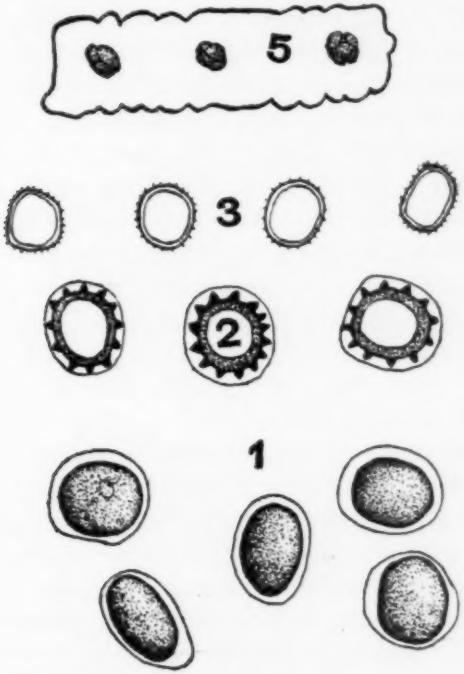


FIG. 1. Spores of *Tilletia externa*. × 630.
FIG, 2. Spores of *Tilletia Earlei*. × 630.
FIG. 3. Spores of *Ustilago elegans*. × 630.
FIG. 5. Spores of *Sorosporium Williamsii*, and outline of the cylindrical spore mass. × 730.

sporium which affect the Compositae. It was very destructive to the host during 1896, '97 and '98 in this very circumscribed area of not over an acre in extent. There were square rods where the host grew to the exclusion of almost all else, having every culm

affected and no seed whatever produced. During five years' collecting it was observed in no other locality, although the host is one of the most common of the prairie grasses and often found in similar situations.

Ustilago elegans sp. nov.

Fructification of fungus occurring within the upper or within the second or third leaf sheath which becomes much enlarged and does not open until the maturity of the parasite which occupies its entire interior. Spores subglobose, angular or often elongated with a small central rather indistinct nucleus, 10–13 μ in diameter; epispore about 1 μ thick, minutely echinulate. (Fig. 3.)

On *Chloris elegans* H.B.K. (309) Cochise, Ariz., Oct. 1900. The method of attack, while similar in all cases studied in the field, presents a great variation which is coördinated with the vigor of the plant. On the general mesa the plants affected with the smut were not usually over one to two and one half inches tall with all but the lower internodes destroyed. In the railroad ditches, however, where the host was stimulated by the accumulation of water, the upper internode together with the head was ordinarily affected. Sometimes both of these methods of attack are to be found in the same plant.

USTILAGO HYPODYTES (Schw.) Fr. and its allies

These culm smuts are exceedingly abundant in many portions of the West on a great variety of hosts. My collections contain them on the following: *Stipa spartea* Trin. (3), *Stipa viridula* Trin., *Stipa occidentale* Thurb. (236), *Agropyron occidentale* Scribn. (234), *Elymus condensatus* Presl. (233), *Elymus striatus* Willd. (201), *Distichlis spicata* (L.) Greene (235). The first of these, collected at Canton, S. D., is referred to *U. minima* Arth. the others to *U. hypodytes* although the author is inclined to the opinion that future cultural and inoculation experiments will result in a segregation of species. Field observations in the Northwest during the past ten years point strongly to such a conclusion. One of the above forms may often be found attacking every individual of a certain species within certain areas while other hosts upon which some of the forms occur may within the same area be entirely unaffected. Notable instances of this have been observed in several localities. At Brookings, S. D., in 1892, 1893 and

again in 1896 *Stipa viridula* was almost completely prevented from making seed in a certain locality while *Agropyron occidentale* in actual contact with it was entirely unaffected. In 1896 and 1897 at Aberdeen, S. D., the same grasses were observed growing together, but in this instance the *Agropyron* was smutted while the *Stipa* was entirely free. In the vicinity of Billings, Mont., in 1900 smutted plants of *Elymus striatus* and *Agropyron occidentale* were both growing with *Stipa viridula* in different situations, but the latter was entirely unaffected. During the past summer *Elymus condensatus* was very badly smutted at Quinn River Crossing, Nev. *Distichlis spicata* growing about its base was entirely unaffected. In another locality in the same general region where the hosts bore the same relation to each other *Distichlis* was badly smutted while *Elymus* was perfectly free from the disease. In one locality, near Andrews, Oregon, they were both found smutted growing side by side.

There are slight differences in spore characters in some of these forms, but they are too slight to warrant the establishment of species upon them. The spores of the forms on *Stipa occidentale* are a trifle larger than any of the others while the form on *Distichlis* has spores with somewhat thicker walls and more restricted central area. The form on *Agropyron occidentale* from Billings, Mont., has the epispore much darker than any of the others. These differences are trifling of course, but when emphasized by the above field observations their importance is magnified very much. It might be added that these differences are fully as great as those which led to the establishment of *U. funalis* E. & E. on *Eriocoma cuspidata*.

USTILAGO MINOR Norton

This species is very abundant and destructive all through southern Arizona. There appears to be in my material a slight difference in the size of the spores of all collections of *Bouteloua oligostachya* whether from Montana or Arizona. All collections on this host are, therefore, referred to *U. filifera* Nort. (217 and 217*a*). *U. minor*, as represented in my collections from Arizona, occurs on *Boutcloua polystachya* (220), *B. aristidoides* (218), *B. criopoda* (219), *B. bromoides* (227), and *Pappophorum Wrightii* (224). It is very destructive to all of these species and may be

commonly found anywhere from the high mountains to the river bottoms. Its method of attack and the extent of injury done are very variable and apparently correlated with the vigor of the host which is dependent in turn upon the supply of moisture and the fertility of the soil. On fertile soil so situated as to receive an abundance of moisture in the vicinity of Cochise, plants of *B. polystachya* with scarcely a leaf or node unsmutted were but little if any reduced in size; but plants of the same species growing on sandy land near Wilcox were reduced to a small rosette of pustules on the surface of the ground, not over three fourths of an inch in diameter, while the length of culm here averaged about five inches. Similar differences were observable in its method of attack when growing on *Bouteloua aristidoides* in the Santa Cruz valley near Tucson.

USTILAGO MULFORDIANA E. & E. AND TILLETIA FUSCA E. & E.

It is strange that these two species have not found their way into herbaria more abundantly than they have, for there are no fungi more plentiful in many portions of Montana, Wyoming, Idaho and Oregon than these two species. The writer has also collected the former in the Santa Rita Mountains in southern Arizona.

It is also rather strange that the two species should be so commonly associated in the Northwest. They have been seen associated together at Sheridan, Wyo., Billings, Missoula and Kalispell, Mont., and Ontario, Ore. At both Billings and Missoula an abundance of plants were found affected by both species. They invariably, of course, select different culms for their fructification. The first species destroys the upper portion of the culm within the enlarged leaf sheath. The latter allows an apparently normal development of all portions of the host except the ovary which is very much enlarged. The host of both species is *Festuca octoflora* Walt. Professor F. S. Earle has compared some of my material with the type of *U. Mulfordiana* in the herbarium of the New York Botanical Garden and reports that the hosts also appear to be the same.

USTILAGO ARISTIDAE Peck

This species is very destructive to *Aristida Scheideana* in Arizona, where it has been observed in several localities, but always

on the same host. Examination of herbarium specimens of the grass shows that the fungus is widely distributed throughout the Southwest. Its persistently tectate condition is very noticeable in all the specimens examined. The author made a large collection (214) in the Santa Catalina Mountains, in Arizona, in Nov. 1900. In the following April, when the locality was visited again, the fungus (214*a*) appeared to be as perfectly preserved as it was five months before. Large herbarium specimens of the host have been seen with every seed destroyed by the smut, but notwithstanding the vast amount of handling, none of them were ruptured.

Professor Norton reports that the fungus causes a shortening of the awns of *Aristida purpurea* in Kansas. Such is not the case with the host mentioned above for there is apparently no modification of any portion of the plant except the ovary.

Sorosporium bigeloviæ sp. nov.

Fungus attacking and destroying the inflorescence especially, but involving also the bracts and often the upper leaves of the branches. The florets become transformed into a globular mass filled with light brown spores and surrounded by a thin pellicle consisting of the modified involucral covering. The leaves become very much swollen especially near the base, the whole interior being transformed into a mass of spores. Spore masses very variable, elongated globular or polygonal and containing 2–6 spores (usually only 3 or 4) commonly 13–21 μ in diameter but often as high as 25–30 μ. Spores globular, globose or compressed and polygonal, 7–10 μ in diameter; epispore thick, distinctly tuberculate and of light straw color. (Fig. 4.)

On *Bigelovia* (399) Tucson, Arizona, Nov., 1900. This was the most common fungus to be found in the Santa Cruse valley near Tucson during the fall and winter of 1900. But, while this is true, it is very likely to be overlooked because the attack of the smut is not at all conspicuous. In one locality north of the city a dense growth of the host along a fence row for a distance of at least ten rods produced almost no seed. Some plants had nearly all the flower heads formed but destroyed, while others had their growth arrested by the abundant fructification of the fungus in the bases of the upper leaves.

FIG. 4. Spores of *Sorosporium bigeloviæ*. × 115.

Sorosporium Williamsii sp. nov.

Fungus producing its spores in the peripheral tissues of the culm of the host within the leaf sheath, transforming them into a black powdery mass and preventing the fructification of the host, the upper node being usually but little developed; two to four nodes are commonly involved; spore mass very loosely united, containing many spores, cylindrical, straight or curved, 65–100 μ × 20–30 μ, scarcely distinguishable at maturity; spores fuscous, subglobose or angular, 5–7 μ in diameter; epispore comparatively thin, smooth, but fissured by a few deep grooves which in optical section often appear to divide it into four approximately equal segments. (Fig. 5.)

Attacking the sheathed culms of *Stipa Richardsonii* Link. (306), Big Horn Mts., Wyo., August 12, 1896 (T. A. Williams & David Griffiths). The species has been collected but once, but it was very abundant and destructive in this place, a large pine clearing at an altitude of about 8000 feet on one of the tributaries of the North Fork of Clear Creek. In habit and gross appearance it is identical with *U. hypodytes* and *U. minima*. The markings of the spores, however, readily separate it from these species even in the over-ripe condition when the spore masses have been broken up.

Gymnoconia riddelliae sp. nov.

Spermogonia hypophyllous, scattered, prominent, honey-yellow, abundant, producing globular hyaline sporidia 2–3 μ in diameter. Aecidia amphigenous, but more abundant below, scattered, circular, oval, or irregular and often confluent over large areas, lilac-purple turning to light brown when dry; spores globular to slightly ovate, 7–8 μ in diameter, epispore smooth and thin. Uredosori amphigenous but more numerous below, circular, small, 0.5 mm. in diameter, long covered by the unruptured epidermis which forms minute whitish spots not noticeable except under a lens; uredospores subglobose or angular and often broadly ovate, 26–29 μ × 20–24 μ, light brown when mature, the epispore thick, finely and evenly tuberculate; teleutospores produced in the same sori as the uredospores and appearing about the time that the epidermis ruptures, the two being mixed for some time, but as the teleutospores develop the sori become enlarged, black and very conspicuous; teleutospores cuneate to elliptical, 38–50 μ × 20–24 μ, broadly rounded or pointed above and conspicuously constricted at the septum, epispore smooth, strongly thickened above, the pedicel hyaline, quite persistent, two to three times the length of the spore. (Fig. 6.)

On leaves and stems of *Riddellia Cooperi* Gray (378, 378*a* and 378*b*), Tucson, Arizona, Nov. 1900. This is a very common species with an interesting distribution. It may be collected at almost any season of the year, but is most conspicuous during the rainy season when the host is in a vigorous growing condition. It is found in situations where the host receives the most moisture and the writer has never collected it on the dryer portions of the mesas. On the contrary, he has seen it usually in shallow washes which receive the drainage waters from higher altitudes. It was especially conspicuous during 1900 and 1901 on the government range reserve at the mouth of a culvert under the railroad. The aecidial stage was abundant here in autumn and spring.

Specimens of this species from the collections of Professor Toumey are to be found in some herbaria under *Puccinia tanaceti* DC.

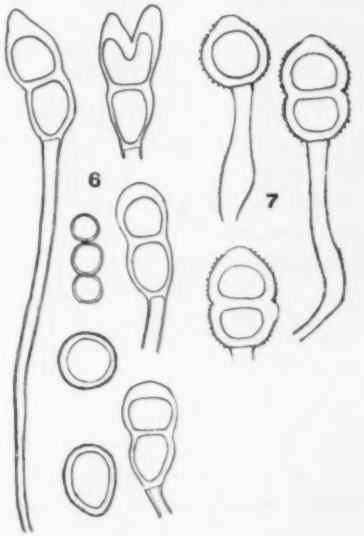


FIG. 6. Æcidiospores, uredospores and teleutospores of *Gymnoconia riddelliae*. All magnified 315 except the aecidiospores which are magnified 500.

FIG. 7. Teleutospores of *Puccinia bouvardiae*. ×315.

Puccinia bouvardiae sp. nov.

Teleutosori mostly epiphyllous but often found below also, circular, scattered, prominent, black and ragged under a lens, the remains of the ruptured epidermis which is at first prominent soon disappearing; teleutospores broadly elliptical, rounded below, with a yellowish umbonate apiculum above, and often a similar projection on the lower cell immediately below the septum, slightly constricted at the septum, 23–28 μ × 36–46 μ; epispore very thick, dark brown, tuberculate; pedicel broad, hyaline, persistent, crooked, one and a half to two and a half times the length of the spore, roughened and commonly enlarged below the middle. (Fig. 7.)

On *Bouvardia triphylla* Salisb. (394), Santa Catalina Mts.,

Ariz., Nov. 1900. Apparently not a common species. This in probably the other stage of *Aecideum bouvardiae* D. & H. Associated with it on the same leaves are the remains of a few old aecidia whose spores correspond very well with that species. The aecidial stage is altogether too old however for one to decide with certainty.

Puccinia Burnettii sp. nov.

Persistently epiphyllous, with very large, scattered, conspicuous sori which often attain a length of 2 cm. and a width equal to that of the leaf, usually causing the edges of the leaf to recurve so as to leave the sorus convex; leaf brown below, the ruptured epidermis prominent but not merely cracking open in the center as usual but being pushed off in large shreds as long as the sorus and often 1–2 mm. in breadth; uredospores subglobose to elliptical or ovate, 20–26 μ in diameter, epispore thick, visibly and evenly tuberculate; teleutospores very uniform, elliptical, very slightly if at all wider above than below, rounded above and below, slightly constricted at the septum, 18–23 μ × 28–31 μ, epispore rather thick, sparsely clothed with short hyaline fugacious projections, ve ry slightly if at all thickened above; pedicel hyaline, 2–4 times the length of the spore. (Fig. 7.)

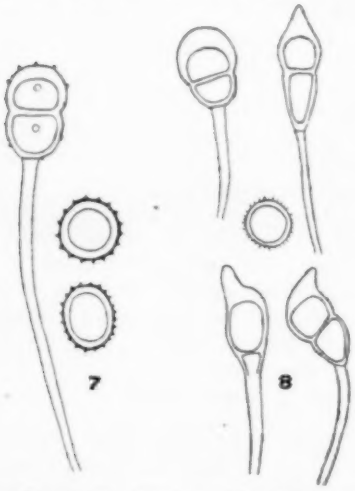


FIG. 7. Uredospores and teleutospore of *Puccinia Burnettii*. × 315.

FIG. 8. Uredospore and teleutospores of *Puccinia micrantha*. × 315.

On *Stipa comata* T. & R. (387), on the Burnett ranch near Buffalo, Wyo., Aug. 1898 (Williams & Griffiths). Later the same season it was collected at Billings, Montana, on the same host. Named for Mr. Burnett who first called my attention to this rust.

The species is remarkable for its persistently epiphyllous character and large sori. Even when occurring on the sheaths, as it does very rarely, the sori rupture on the inside and its position is distinguishable by a slight distortion and purplish or brownish coloration on the outside as on the leaf.

Puccinia micrantha sp. nov.

Sori epiphyllous, with both uredo- and teleutospores produced in the same sori which are usually short, linear or circular, scattered evenly over the surface, conspicuous, black, prominent, without visible remains of ruptured epidermis; uredospores subglobose, minutely, rather sparsely but evenly echinulate, 15–17 μ in diameter, the epispore rather thick and prominent in optical section; teleutospores very variable, obovate to oblong-elliptical, very slightly to conspicuously constricted at the septum, the base rounded, the apex broadly rounded or long-pointed, strongly thickened, 13–24 μ × 30–45 μ; pedicel once to twice the length of the spore, hyaline or slightly tinted at the base of the spore. (Fig. 8.)

On living leaves of *Oryzopsis micrantha* (T. & R.) Thurb. (386), Billings, Mont., Sept. 1898 (Williams & Griffiths). This is such a common and familiar species to me that it is with considerable hesitancy that it is given a distinct name. It seems almost impossible that it has not been collected by others; but careful search has not revealed a record of it. It was first collected by Griffiths and Schlosser at Forest City, South Dakota, in 1892 and subsequently in the same locality in 1897 by Griffiths and Carter. Specimens from the first collection are in herbaria of the writer, the agricultural college of South Dakota and the agricultural college of North Dakota. There was also a specimen in the private herbarium of the late Professor T. A. Williams. A large sheaf of the host, all badly rusted, was collected and deposited in the collection of the agricultural college of South Dakota in 1892. It was the intention to have put it up for distribution, but judging from the notes on p. 74 of bulletin no. 40 of that institution it may have been all destroyed except the specimens cited. Professor Bolley, to whom specimens were submitted, reported at the time that the fungus had "characters of its own." Although remembering the specimen, he is unable, owing to removal to new quarters, to find it now.

Aecidium grindeliae sp. nov.

Aecidia usually clustered in brown somewhat thickened areas of the leaf tissue, occurring about equally on both sides of the same spot, each cup forming a distinct papilla having finally a circular or oval or lenticular opening through which the spores escape, the peridium not projecting beyond the raised epidermis of the

leaf; aecidiospores globose or angular-compressed, light brown, 20–24 μ in diameter, the epispore thick and very minutely roughened. (Fig. 10.)

Fig. 10. One spore × 315, and diagram of vertical section of leaf showing outline of cup of *Æcidium Grindeliae*. × 315.

On *Grindelia squarrosa* Dunal. (388), Columbia, S. D., June, 1897. This species, although abundant in the locality and on the date mentioned, is apparently rare in the region.

Aecidium Dakotensis sp. nov.

Spermogonia brown or brown-black under a hand lens, yellow by transmitted light, hypophyllous, evenly scattered, very prominent; aecidia hypophyllous and uniformly scattered often over the entire lower surface, the upper surface being marked by small, circular, brown elevations which mark the position of the aecidia below; pseudoperidium very conspicuously lacerated into broad segments which are strongly recurved; aecidiospores globose or compressed-angular, 15–18 μ in diameter, epispore smooth and while not particularly thick is very conspicuous and often thickened at the angles.

On *Aquilegia Canadensis* L. (389), Big Stone Lake, S. D., June, 1895. Apparently a rare species.

Claviceps? caricina sp. nov.

Mycelium of the fungus extending throughout the entire substance of the parenchymatous tissue of the center of the culm of the host, and condensing in one to four places into black, longitudinally-striated sclerotia 1.5–5 mm. × 1–5 cm., the interior of which is white, of uniform density and made up of loosely interwoven, colorless, thick-walled and sparingly septate hyphae.

Invariably associated with the above sclerotia are found, in upper portion of the culm, elongated black sori which rupture the epidermis much like a rust and resemble in structure a *Gloeosporium* with hyaline globular spores 1–2 μ in diameter.

On *Carex Nebraskensis* Dewey, Andrews, Ore., Aug. 1901 (Griffiths & Morris). Faithful but unsuccessful attempts have been made to cultivate the sclerotia of this interesting species during the past three months. No one realizes better than the writer that the placing of the species in the genus *Claviceps* is

a wild guess, but it seems wise to call attention to the fungus in this way that others may look for it.

On the whole the species is very inconspicuous, but when once seen it can be readily detected afterward. The most noticeable character is the rather early death of the culm while the lower leaves are still green; but this is likely at times to be mistaken for the maturing of the plant. The *Gloeosporium* stage is indistinct until late and really does not become noticeable until the sclerotia have disappeared as described below. Usually the sclerotia are formed in the lower half of the culm and fill its entire vertical section; but they may frequently be formed above the middle and even near the head in close proximity to the *Gloeosporium*-like form above. The method of liberation of the sclerotia is very interesting. The culm is killed, and consequently becomes dry, about the time that the sclerotia are mature. In drying, the sclerotia curve into a segment of a circle, thereby rupturing the tissues and falling to the ground. In searching for the cause of the early drying up of the upper portion of the plant it was these ruptures that first attracted my attention and it was only after a long search that the cause was discovered. The external resemblance of the sclerotia to those of *Claviceps purpurea* is very marked.

Supplementary Notes on the Erysiphaceae

By E. S. Salmon, F.L.S.

(Concluded from page 210)

Excluded or doubtful Species

Erysiphe album Fries, Observ. Myc. 1 : 207. 1815. *E. album* Achar.—There is no specimen of this plant in Fries' herbarium at Upsala, but I have seen the single specimen that the Acharian herbarium at Lund possesses. There is, unfortunately, no trace of any fungus now to be found on the leaf mounted on the sheet labeled *Erysiphe album*. As the description given by Fries ("*Erysiphe album*, receptaculo tenuissimo subnullo, capitulis nigris. In foliis *Juglandis* in Helvetia. Nudo oculo ut puncta alba apparet") is altogether inadequate to make identification possible, the name must be allowed to drop.

I have been able, through the kindness of M. P. Hariot, to examine the types contained in the Paris Museum, of the following, published by Mérat, in "Revue de la Flore Parisienne," 459. 1843.

"*Erysiphe lathyri* Mérat.—Granules très fins, spheriques, noirs, rares, sans apparence de filaments basilaires, naissant sous les feuilles du *Lathyrus latifolius* L."

The minute irregularly shaped black bodies on the leaves are not of fungous origin, but are probably the excrementa of some animal.

"*E. saxifragae Sibericae* Mérat.—Le dessous des feuilles de cette plante [*Saxifraga Siberica*] a parfois, en été, des myriades de petits granules noirs, sphériques ; d'autres fois, comme cylindroïdes, un peu pénicillés (à la loupe), avec l'apparence d'une membrane ténue, à reflet argenté dans leurs intervalles."

The bodies here described have certainly nothing to do with the Erysiphaceae. They are not, I think, of fungous origin, but appear to be the work of mites.

E. tiliae Mérat.—Les granules sont d'une finesse excessive, peu abondants, noirs, arrondis, et reposent sur des taches blanchâtres, qui décolorent en cel endroit le dessous des feuilles du Tilleul

où on les observe. La loupe ne découvre aucun filament basilaire dans cette plante."

The discolorations here referred to are the work of mites, the bodies of which occur on the leaves; the black rounded granules are their excrementa.

Hazslinzky (**27**, p. 182) has described a fungus as follows (I am indebted to Professor A. Mágócsy-Dietz for the translation from the Hungarian).

"*Calocladia bicornis* (Wallr.) *b. rosae* Wallr. Das Mycelium besteht aus sehr spärlichen Fäden. Perithecien zerstreut und nicht zahlreich, mit 7–8 Asci; die Asci mit 7 Sporen Auf den Blättern der *Rosa cinnamomea* in der Umgebung von Eperjes, Königreich Ungarn."

It is impossible from this description to identify the fungus. Wallroth (Ann. Wett. Ges. **4**: 238. 1819) described a species as *Alphitomorpha rosarum*, on *Rosa cinnamomea*, and later (Fl. Crypt. Germ. **2**: 755. 1833) placed it as a variety under "*A. penicillata*." This plant of Wallroth's has never been identified by later authors.

Roumeguère (**64**) reported in 1880 the occurrence of an *Erysiphe* on *Prunus Laurocerasus* at Tarbes (Hautes-Pyrénées) France, which he named as a new species, *Erysiphe Bertoloni*. The author observed that the leaves of the *Prunus* were abundantly covered in July with *Oidium Passerini* Bertol. fils. The only description given of the *Erysiphe* runs as follows: "Quelques périthéces (fines ponctuations noirâtres), analysés par moi m'out moutré dans chaque conceptacle 4 thèques ovoïdes renfermant 5–7 spores de couleur brune. Je ne peux rapporter cette Erysiphée à aucune espèce connue." It is impossible to say from this description what the fungus was, but the brown spores, if correctly described, preclude it from belonging to the Erysiphaceae. Dr. R. Ferry informed me that no specimen of "*E. Bertolini*" is to be found in Roumeguère's herbarium.

Spegazzini (**79**) had described an *Erysiphe* as a new species under the name of *E. deserticola*, with the following diagnosis: "Amphigena; subiculum submembranaceum canescens arcte adnatum, peritheciis sparsis globosis atris, ascis paucis 2–4-spermis, sporis subcylindricis obtusis. *Hab.* ad folia *Hoffmanseggiae* cujusdam in deserto Valle de Santa María, prov. Salta, Jan. 1897.—*Obs.* Subiculum tenue e pulverulento membranaceo-subcrusta-

ceum matrice arctissme adpressum canescens, ex hyphis densissime intertextis tenuibus (3–4 μ crass.) ramulosis septulatis hyalinis efformatum: perithecia pauca sparsa amphigena globoso-depressa (100–150 μ diam.) atro laevia astoma, hyphis basalibus paucis radiantibus radicata, tenui-membranacea, contextu minute parenchymatico e ferrugineo ochraceo; asci pauci ovati v. obovati (50–60 μ long. × 25–35 μ diam.) brevissime stipitati aparaphysati, 2–4-spermi; sporae subcylindraceae (40 μ long. × 12 μ crass.) utrimque obtusissimae e latere (praecipue in parte media) compressae, laeves, hyalinae, tenuiter tunicatae, nubiloso-farctae."

In the specimen sent to me by Professor Spegazzini I was unable to find more than one or two quite immature (yellowish) perithecia. The subpersistent mycelium is of the same appearance and consistency as that commonly found in examples of *E. polygoni* (*e. g.*, in specimens on *Geranium*, *Anemone*, *Polygonum erectum*, *Peucedanum Oreoselinum*, etc.), and there are no characters given in the diagnosis quoted above, except that of the length of the spores, to separate "*E. deserticola*" from this cosmopolitan species.

Although "*Erysiphe euphorbiae* Peck" (= *Microsphaera euphorbiae* Berk. & Curt.) has been twice recorded from Belgium—by Bommer and Rousseau, Bull. Soc. Roy. Bot. Belg. **25**: 169. 1886, and Lambotte, Fl. myc. Belg. Supp. **1**: 90. 1887—it is very improbable that the fungus found really belonged to this North American species. The examples recorded by Bommer and Rousseau occurred on *Euphorbia amygdaloides*. In specimens (now in the Kew herbarium) sent by Mme. Bommer, from "Poix (Belgique), Sept. 1885," on which the record mentioned above was based, no perithecia are to be found. Dr. Lambotte informs me that no specimens exist of the example recorded by him. The description given in Fl. myc. Belg. (*l. c.*), it may be noted, is a repetition of Peck's original diagnosis (Reg. Rep. **26**: 80. 1874), and has therefore probably not been drawn up from characters shown by a Belgian plant. It is quite possible that the "*E. euphorbiae*" of Belgium is *Sphaerotheca euphorbiae* (Cast.). Serbinov (**76**) records "*Erysiphe* (?) *euphorbiae* Peck," on *Euphorbia virgata*, from Russia; I have seen no specimens of this.

Microsphaera diffusa Cooke & Peck has been recorded by Serbinov (**76**) on *Lathyrus pratensis* L. from St. Petersburg, Russia. *M. diffusa* is a North American (United States) species, and the

Russian plant, I am inclined to think, will prove more probably to belong to the European species *M. Bäumleri* P. Magn.

Serbinov (**76**) has described as a new variety of "*Erysiphe lamprocarpa* Lév.," from Russia, the following plant on *Polemonium coeruleum:*

"Var. *polemoniacearum* Serb. Varietas amphigena, mycelio denso, niveo, persistente, peritheciis globosis, maioribus compactius gregariis, appendicibus fuscis, haustoriis partim lobulatis, partim non lobulatis, ascis (5–8) constante bisporis." "Unter dem von Prof. Schmalhausen gesammelten Materiale fand ich bei Bestimmung desselben eine Form auf Blättern von *Polemonium coeruleum* L., welche sehr der *Erysiphe lamprocarpa* (Wallr.) Lév. ähnelt, und sich jedoch durch folgende Merkmale von obiger Art unterscheidet: Die Perithecien sind etwas grösser und sehr dicht gedrängt, die Haustorien bei einigen Exemplaren *non lobulati*, bei anderen *lobulati*, während sei bei *E. lamprocarpa* stets *non lobulati* sind. Nach De Bary sind bei *E. lamprocarpa* 2 oder 3 Ascosporen, bei den von mir untersuchten Formen stets nur 2 Ascosporen."

I have not seen a specimen of this plant; from the description above given it seems to be a form intermediate between *E. cichoracearum* and *E. galeopsidis*.

Serbinov (**76**, p. 23) records finding a species of *Erysiphe* in an immature condition on the leaves of *Betula alba* (*B. verrucosa* Ehrh.), in the neighborhood of St. Petersburg.

BIBLIOGRAPHY

1. **Amici, G. B.** On the Disease of the Vine. Journ. Hort. Soc. Lond. **8**: 231–241. 1853.
2. **Arthur, J. C.** Report of the Botanist to the N. Y. Agric. Exper. Sta. Rep. N. Y. Agric. Exper. Sta. **5**: 275, 276. 1887.

2*. **Bailey, L. H.** Bull. Cornell Univ. Agric. Exper. Sta. 31: 138. 1891.

2**. ——— *l. c.* 74: 381. *f.* 9. 1894.

2***. **Beach, S. A.** Gooseberries. Bull. N. Y. Agric. Exper. Sta. 114: 1897.

3. **Beck, G.** Flora von Südbosnien und der angrenzenden Hercegovina. Annal. k. k. Naturhistor. Hofmus. Wien. **1**: 302. 1886.
4. **Berkeley, M. J.** Gard. Chron. 269. 1846.
5. ——— Journ. Hort. Soc. Lond. 6: 284–295. 1851. Translation with notes, of Léveillé's "Recherches sur la maladie des vignes."

6. **Blónski, F.** Symb. ad flor. myc. Poloniae. Pamietnik Fizyograficzny, **14**: 91, 92. 1896.

7. **Bonorden, H. F.** Beiträge zur Mykologie. Bot. Zeitung, **19**: 195. *pl. 8. f. 8.* 1861.

8. **Brannon, M. A.** Some Indiana Mildews. Proc. Ind. Acad. Sci. 1898: 291–295. 1899.

9. **Bubák, F.** Result. der mykolog. Durchforsch. Böhmens im Jahre 1898. Sitzungsber. k. böhm. Gesell. Wissensch. (Prag.) **11**: 23–25. 1899.

10. ——— Mykolog. Beitr. aus Bosnien und Bulgarien. *l. c.* 1900.

11. **Büsgen, M.** Ueber einige Eigenschaften der Keimlinge parasit. Pilze. Bot. Zeitung, **51**: 65. 1893.

12. **Casali, C.** Contrib. alla conosc. della fl. mic. avell. Bull. Soc. Bot. Ital. 1900: 25.

13. ——— *l. c.* 226.

13*. **Comes, O.** Crittogamia agraria, 220–254. 1891.

14. **Dangeard, P. A.** Le Botaniste, **7**: 119–130. 1900.

15. **Davis, J. J.** Second supplementary List of parasitic Fungi of Wisconsin. Trans. Wis. Acad. **11**: 165, 166, 170. 1898.

15*. **Despeissis, A.** Two prevalent Blights; Apple and Pear Powdery Mildew. Journ. Dep. Agric. of Western Australia, **4**: 394, 395. *f.* 1901.

16. **De Wildeman, E., & Durand, Th.** Prod. Fl. Belg., Thallophytes. fasc. 2, 219, 222. 1898.

17. **Earle, F. S.** In Mohr: Plant Life of Alabama. Contrib. U. S. Nat. Herb. **6**: 165–167. 1901.

18. **Feltgen, J.** Vorstudien zu einer Pilzflora des Grossherzogthum Luxemburg. Recueil des Mém. et des Trav. Soc. bot. Grand-Duché Luxembourg, **14**: 356–365. 1899.

19. **Ferraris, T.** Mater. Fl. Micol. Piemonte. Malpighia, **14**: 211. 1900.

20. **Freeman, E. M.** A preliminary list of Minnesota Erysipheae. Minnesota Bot. Studies, **1**: 423–430. 1900.

21. **Goethe, R.** Bericht. Königl. Lehranstalt für Obst- und Weinbau zu Geisenheim a. Rh., 1890–91. Review in Bot. Centralbl. **54**: 142. 1893.

22. ——— Bericht. Köngl. Lehranstalt für Obst- Wien- u. Gartenbau zu Geisenheim a. Rh. 1898–99: 24.

23. **Halsted, B. D.** The Powdery Mildew of the Gooseberry. Rep. Com. Agric. 1887: 373–380. *pl. 11.* Washington, 1888.

23*. ——— New Jersey Agric. Exper. Stat. 1894: 331, 362, 363.

23 * *.——— Bull. Iowa State Agric. Coll., 112. 1888.

24. **Hammond, W. H.** On Red Mould in Hops. Journ. S. E. Agric. Coll. Wye (England), **9**: 19, 20. 1900.

25. **Harper, R. A.** Sexual Reproduction in *Pyronema confluens*, and the Morphology of the Ascocarp. Annals of Botany, **14**: 327–396. 1900.

26. **Harz, C. O.** Bot. Centralbl. **32**: 313, 314. 1887.

27. **Hazslinszky, F.** Magyarhon Üszökgombái és Ragyái, 174–188. M. Tud. Akad. Math. és Természettud. Közlemények, **14**: 174–188. 1876–77.

28. ——— Uj Adatok Magyarhon Gombavirányához. *l. c.* **15**: 20–22. 1878.

29. ——— Elömunkálatok Magyarhon Gombavirányához. *l. c.* **19**: 89, 90. 1883.

30. **Hennings, P.** Fungi amer. bor. Hedwigia, **37**: 275. 1898.

31. ——— Fungi japonici. Engler's bot. Jahrbüch. **28**: 271, 272. 1900; **29**: 147–150. 1900.

31 *. **Humphrey, J. E.** The Powdery Mildew of the Cucumber. Rep. Mass. State Agric. Exper. Sta. **9**: 222–226. 1892; **10**: 225, 226. *pl. 3*. 1893.

32. **Iwanowsky, D.** Ueber zwei Krankheiten der Tabakspflanze. Land- und Forstwirthsch. 1892 (review in Bot. Centralbl. Beihefte, **3**: 266, 267. 1893.

33. **Jaap, O.** Ein kleiner Beitrag zur Pilzflora von Tirol. Deutsche Botan. Monatsschr. **19**: 136. 1901.

34. **Jaczewski, A. de.** Florule crypt. d'Ecône, VIII. Bull. Soc. Murith. Valais.

35. Journ Roy. Hort. Soc. (London) **25**: clxxvi. *pl. 3*. 1901.

36. **Kirk, T. W.** Gooseberry-leaf Mildew. Journ. Roy. Hort. Soc. (Lond.) **25**: 145. 1900.

37. **Lavergne, J.** La *Cuscuta* de la vigne et l'*Oidium* au Chili. Revue de Viticulture, **14**: 345–347. Review in Bot. Centralbl. **87**: 33. 1901.

38. **Lemmermann, E.** Erst Beitrag zur Pilzflora der ostfriesisch. Inseln. Abhandl. naturwiss. Ver. Bremen, **16**: 444. 1900.

39. **Léveille, J. H.** Recherches sur la maladie des vignes. Revue Horticole, June 18, 1851. Translated, with notes, by Berkeley. See no. **4**.

40. **Lindau, G.** Hilfsbuch für das Sammeln parasit. Pilze. 1901.

40 *. **Lodemann, E. G.** The Spraying of Plants, 241, 281, 292, 303, 325, 331, 359, 365. *f. 52, 57, 61, 68, 87, 90*. 1896.

41. **Lüstner, G.** Die Perithecien des *Oidium Tuckeri*. Mitteil. über Weinbau u. Kellerwirtsch. **12**: no. 12. 1900.

42. ——— Ueber einen Mehltaupilz der Birnbäume. Mitteil. über Obst- und Gartenbau, **16**: 81–83. 1901.

43. **Magnus, P.** J. Bornmüller, Iter Syriacum, 1897. Verh. k. k. zool.-bot. Gesell. Wien, **50**: 444, 445. 1900.

44. ——— Ueber den Mehltau der Apfelbäume. Centralbl. f. Bakter. Parasit. u. Infektionskrankh., II Abth. **6**: 253–255. 1900. [Illust.]

45. ——— Replik auf C. Wehmer's Bemerkung zum Mehltau der Apfelbäume. *l. c.* 704, 705.

46. ——— Ueber einige auf unseren Obstarten auftretende Meltauarten. Gartenflora, **49**: 58–60. 1900. [Illust.]

47. ——— Weitere Mitteilung über den Meltau einiger Obstarten. *l. c.* **50**: 412–414. 1901.

47*. ——— Hedwigia, **40**: 180–181. 1901.

48. **Mallett, G. B.** Gard. Chron. **26**: 166, 167. 1899.

49. **Marchand, L.** Tweede Verh. over de Crypt. Planten van het Groothertog. Luxemburg. Bijdr. tot de Natuurk. Wetensch. Amsterdam, **4**: 272. 1829.

50. **Massalongo, C. B.** Contrib. alla micolog. Veron. Accad. Agric. Art. Com. Verona, III. **65**: review in Bot. Centralbl. **40**: 42. 1889.

51. **Massee, G.** Appearance of American Gooseberry Mildew in Ireland. Gard. Chron. **28**: 143. 1900.

52. **Neger, F. W.** Beitr. zur Kenntniss der Gattung *Phyllactinia* (nebst einigen neuen argentin. Erysipheen). Bericht. Deutsch. Bot. Gesell. **17**: (235)–(242). *pl. 23*. 1900.

53. ——— Weiteres über *Phyllactinia*. Bot. Centralbl. **82**: 261–264. 1900.

54. ——— Beiträge zur Biologie der *Erysipheen*. Flora, **88**: 333–370. *pl. 15–17*. 1901.

54* ——— Über einige neue Gesichtspunkte zur Frage der praktischen Bekämpfung der schädlichen Mehltaupilze. Zeitschr. für Pflanzenkrankh. **11**: 207–212. 1901.

55. *New York Agric. Exper. Station.* Bull. 191: 330. 1900.

56. *New Zealand Dep. Agriculture.* Leaflet for Gardeners, 34: 3. 1899.

57. **Pammel, L. H.** Powdery Mildew of the Apple. Proc. Iowa Acad. Sci. **7**: 177–182. *pl. 33–35*. 1900.

58. **Percival, J.** Agricultural Botany, 724–734. 1900.

58*. **Pierce, N. B.** The California Vine Disease. Bull. U. S. Dept. Agric. (Div. Veg. Pathol.) **2**: 166–170, 208. 1892.

59. **Rabenhorst, L.** Uebersicht der vom Herrn Prof. Dr. Haussknecht im Orient gesamm. Kryptogamen. Sitzungsber. naturw. Gesell. "Isis" zu Dresden, **4**: 7. 1870.

60. **Raciborski, M.** Parasit. Algen u. Pilze Java's, **1**: 15. 1900.

61. **Rehm, H.** Beitr. zur Pilzflora von Südamerika. Hedwigia, **40**: 149, 150. 1901.

62. **Rodway, L.** Tasmanian Fungi. Proc. Roy. Soc. Tasmania, 1897: 141. 1898.

63. **Rostrup, E.** Fungi from the Faeröes, 309. Reprinted from the "Botany of the Faeröes," Pt. 1, Det Nordiske Forlag, Copenhagen. 1901.

64. **Roumeguère, C.** Appar. en France d'une mucédinée nouvelle: l'*Oidium Passerini* Bertol. fils, état conidien d'un *Erysiphe* nouveau, l'*E. Bertoloni*. Rev. Mycolog. **2**: 174–176. 1880.

65. **Saccardo, P. A. & Cavara, F.** Funghi di Vallombrosa. Nuovo. Giorn. Bot. Ital. II. **7**: 278. 1900.

66. **Saccardo, P. A. & Bresadola, G.** Enum. Fung. Valses. Malpighia, **13**: 434, 435. 1900.

67. **Salmon, E. S.** A Monograph of the Erysiphaceae. Mem. Torrey Club, **9**: 1–292. *pl. 1–9*. 1900.

68. ——— The Erysiphaceae of Japan. Bull. Torrey Club, **27**: 437–450. *pl. 26*. 1900.

69. ——— A new species of *Uncinula* from Japan. Journ. of Bot. **38**: 426, 427. 1900. [Illust.]

70. ——— New or Rare British Fungi. Journ. Quekett Micr. Club, II. **7**: 371, 372. *pl. 20. f. 1–3*. 1900.

71. ——— The Strawberry Mildew and the Gooseberry Mildew. Journ. Roy. Hort. Soc. **25**: 132–142. *f. 35–37*. 1900.

72. ——— Der Erdbeer- und der Stachelbeer-Mehltau. Zeitschrift für Pflanzenkrankheiten, **11**: 73–81. 1901.

72*. **Schlichting.** Zur Bekämpfung des Apfelmehltaues. Der prakt. Rathgeber in Obst- und Gartenbau, Jahrg. no. 16. Reviewed in Bot. Centralbl. **87**: 70. 1901.

73. **Scribner, F. L.** Fungous Diseases of Plants. Rep. Com. Agric. 1885: 81. Washington. 1885.

74. ——— Rep. Com. Agric. 1886: 105–109, 115, 116. *pl. 2*. Washington. 1887.

75. **Selby, A. D.** Bull. Ohio Agric. Exper. Stat. 73: 219–246. 1897. Reviewed in Just's Bot. Jahrb. for 1898, **2**: 329. 1901.

75*. ——— Preliminary Report upon Diseases of the Peach. Bull. Ohio Agric. Exper. Sta. 92: 225, 226. 1898.

76. **Serbinov, J.** Die Erysipheen des Gouv. t. Petersburg. Scripta Bot. Hort. Univ. Petropol. 18: (1–30). 1901.

77. **Smith, Grant.** The Haustoria of the Erysipheae. Bot. Gaz. **29**: 153–184. *pl. 11, 12.* 1900.

78. **Sorauer, P.** Schutz der Obstbäume gegen Krankheiten, 63–65, 205, 206. 1900.

79. **Spegazzini, C.** Fungi argentini novi vel critici. Anal. Museo nac. de Buenos Aires, **6**: 242, 243, 330, 331. 1899.

79*. **Speschnew, N. N.** Fungi parasitici transcaspici et turkestanici novi aut minus cogniti. Arb. Bot. Gard. Tiflis, **5**: 161–165. *pl. 1. f. 1–16.* 1901.

80. **Sredrinski.** Proc. New Russ. Soc. Naturalists (Odessa), **2**: 106–108. 1873.

81. **Stewart, F. C** Powdery Mildew on field-grown Cucumbers. Bull. N. Y. Agric. Exper. Sta. 164: 213, 214. 1899.

82. **Sydow, H. & P.** Fungi novi japonici. Mém. de l'Herb. Boiss. 4: 4. 1900.

83. **Tucker, E.** Gardeners' Journal, Oct. 2, 1847.

84. **Underwood, L. M.** Proc. Indiana Acad. Sci. 1893: 35–41. 1894.

85. **Vuillemin, P.** A propos des tubes pénicillés des *Phyllactinia*. Rev. Mycolog. **22**: 124, 125. 1900.

86. **Wehmer, C.** Pilzkrankheit. von Kulturpflanzen in der Prov. Hannover, II. Centralbl. f. Bakter. Parasit. u. Infektionskrankh. Abth. II, **6**: 51–54. 1900.

87. ——— Bemerkung zum Mehltau der Apfelbäume. *l. c.* 429, 430.

88. **Wortmann, J.** Zur Bekämpfung des *Oidium Tuckeri*. Mitth. über Weinbau u. Kellerwirtsch. 1900: 1–6. (reviewed in Centralbl. f. Bakter. Parasit. u. Infektionskrankh., Abth. II, **6**: 301, 302. 1900.

89. **Zopf, W.** Ueber einen neuen Inhaltskörper in pflanzlichen Zellen. Ber. Deutsch. bot. Gesellsch. **5**: 275–281. *pl. 13.* 1887.

HOST-INDEX

(All records have been personally verified, except in the case of those plants prefixed by *, the authority for these will be found indicated in the list of host-plants given under the species in question.)

Acer opulifolium, palmatum, spicatum Ukuruduense.....U. aceris.
*Aconitum variegatum.....E. polygoni.
Actinostemma racemosum.....E. polygoni.
Adesmia sp.....P. corylea.
*Aesculus Hippocastanum.....P. corylea.

Alchemilla Helvetica.....S. humuli.
*Alhagi maurorum.....E. polygoni.
Alnus incana glauca, viridis.....P. corylea.
Amelanchier Asiatica.....P. corylea.
Anarthrophyllum rigidum.....P. corylea.
*Anemone nemorosa.....E. polygoni.
Arabis alpina.....S. humuli fuliginea.
*Arctium minus.....S. "Castagnei."
*Artemisia maritima Stechmaniana.....E. cichoracearum.
*A. serrata.....E. cichoracearum.
*Aster sp.....E. polygoni.
A. *azureus, *lateriflorus, *Novae-Angliae, *undulatus.....E. cichoracearum.
*Ballota nigra.....E. polygoni.
Berberis vulgaris.....M. alni.
*Betula pumila.....M. alni.
*Bidens bipinnata.....E. cichoracearum.
B. pilosa.....S. humuli fuliginea.
Bowlesia tenera.....E cichoracearum.
*Brassica oleracea.....E. polygoni.
Bromus mollis, *unioloides.....E. graminis.
*Bupleurum linearifolium.....S. "Castagnei."
Caesalpinia sepiaria.....P. corylea.
*Calamintha Acinos.....E. galeopsidis.
C. umbrosa.....S. humuli fuliginea.
*Calendula arvensis, *fulgens.....E. cichoracearum.
*C. fulgens.....S. humuli.
Caragana frutescens.....M. euonymi.
*Carpinus Americana.....M. alni.
*Catabrosa aquatica.....E. graminis.
Celtis *Boliviensis, *Selloviana, Sinensis.....U. polychaeta.
C. Sinensis.....U. Clintonii.
*Centaurea Babylonica.....S. "Castagnei."
C. *Cyanus, pectinata.....E. cichoraceorum.
Ceratonia Siliqua.....Oidium ceratoniae Comes (see p. 188).
*Cerinthe sp.....E. taurica
Chionanthus Virginica.....M. alni.
*Cineraria sp.....E. cichoracearum.
Clerodendron trichotomum.....S. humuli fuliginea.
Cnicus arvensis.....E. cichoracearum.
* " " .....S. "Castagnei."
*Coreopsis trichosperma.....S. humuli fuliginea.
Corylus rostrata Sieboldiana.....M. alni (forma).
*Crataegus nigra.....P. corylea & P. oxyacanthae.
C. parvifolia.....P. corylea.
C. sanguinea, *tanacetifolius.....P. oxyacanthae.
Crepis virens.....S. humuli fuliginea.
*Cytisus capitatus.....E. polygoni.

*C. purpureus ..... E. cichoracearum.
Delphinium hybridum, Maackianum ..... E. polygoni.
*Desmodium sp. ..... P. corylea.
D. podocarpum Japonicum ..... E. polygoni.
*Dinebra Arabica (cult.) ..... E. graminis.
*Dipsacus silvestris ..... E. polygoni.
*Dorycnium herbaceum ..... E. taurica.
*Echinops sp. ..... E. polygoni.
*Echinospermum Lappula ..... E. cichoracearum.
Echium vulgare ..... E. cichoracearum.
Embothrium coccineum ..... P. corylea.
*Epilobium obscurum ..... S. humuli.
*Euonymus Europaeus ..... "M. euonymi. borealis."
*Eupatorium ageratoides ..... E. cichoracearum.
Euphorbia sp. ..... E. cichoracearum.
E. *Cyparissias, palustris ..... S. euphorbiae.
*E. virgata ..... "E. (?) euphorbiae" (see p. 304).
Excoecaria sp. ..... P. corylea.
Fragaria (cult.) ..... S. humuli.
*Fraxinus oxyphylla ..... P. corylea.
*Galeopsis Ladanum ..... E. galeopsidis.
Geranium dissectum ..... S. humuli.
G. *pratense, *Robertianum ..... E. polygoni.
Geum Chiloënse ..... E. polygoni.
G. rivale ..... S. humuli.
*Hedera Helix ..... U. salicis (see p. 97).
*Helianthus parviflorus ..... E. cichoracearum.
*Heuchera Americana ..... E. polygoni.
*Hieracium umbellatum ..... E. polygoni.
* " " ..... E. cichoracearum.
Hoffmanseggia sp. ..... "E. deserticola" (see p. 303).
*Holcus lanatus ..... E. graminis.
*Hydrophyllum appendiculatum, *macrophyllum ..... E. cichoracearum.
*Hypericum tetrapterum ..... E. polygoni.
*Ilex verticillata ..... M. alni.
Impatiens Balsamina ..... S. humuli fuliginea.
Inula Britannica ..... E. cichoracearum.
*Isopyrum thalictroides ..... E. polygoni.
*Juglans sp. ..... P. corylea.
Lamium amplexicaule ..... E. galeopsidis.
Lathyrus *Clymenum, montanus, *niger ..... E. polygoni.
L. niger ..... M. ? Bäumleri.
*L. ochroleucus ..... E. polygoni.
L. palustris ..... M. alni.
*L. palustris ..... E. polygoni.
*L. pratensis ..... M. diffusa (see p. 304).

L. venosus, *vernus ..... E. polygoni.
*Leonurus Cardiaca ..... E. polygoni.
Lonicera hirsuta, Sullivantii ..... M. alni.
*Lolium perenne ..... E. graminis.
Lupinus angustifolius ..... E. polygoni.
*Lycopersicum esculentum ..... E. polygoni.
Magnolia Yulan ..... P. corylea.
Marrubium peregrinum ..... E. taurica.
*Melampyrum silvaticum ..... E. polygoni.
*Mentha arvensis ..... E. polygoni.
Microseris tenella ..... S. humuli fuliginea.
*Milium effusum ..... E. graminis.
Myoschilos oblongum ..... M. alni.
*Myosotis sp. ..... E. polygoni.
* " " ..... E. cichoracearum.
M. *collina, *palustris, *sparsiflora, *stricta ..... E. cichoracearum.
*Onobrychis Crista-galli ..... E. polygoni.
Papaver Rhoeas ..... E. polygoni.
Parietaria *Canadensis, *Judaica ..... E. cichoracearum.
*Phaseolus vulgaris ..... E. polygoni.
*Phlomis Herba-venti ..... E. cichoracearum.
P. tuberosa ..... E. galeopsidis.
Phtheirospermum Chinense ..... S. humuli fuliginea.
*Physalis sp. ..... S. polygoni.
P. Alkekengi ..... E. cichoracearum.
*Pilea pumila ..... E. cichoracearum.
*Pisum arvense ..... E. polygoni.
*Plantago Coronopus ..... E. cichoracearum.
*P. major ..... S. "Castagnei."
Pleurospermum Uralense ..... E. polygoni.
*Poa alpina ..... E. graminis.
*Polemonium coeruleum ..... "E. lamprocarpa polemoniacearum" (see p. 305).
*Populus sp. ..... P. corylea.
P. suaveolens ..... U. salicis.
*Potentilla collina ..... S. humuli.
*P. reptans ..... P. oxyacanthae tridactylâ (see p. 85).
*P. Sibbaldi ..... S. humuli.
Prunus Grayana ..... P. oxyacanthae tridactyla.
*P. Persica ..... P. oxyacanthae.
*Pyrus Aucuparia ..... P. oxyacanthae tridactyla.
*P. communis ..... P. leucotricha.
*P. Malus ..... P. corylea.
Quercus cinerea ..... M. alni extensa.
Q. discolor ..... M. alni.

Q. glandulifera ..... S. lanestris.
Q. glandulifera ..... U. septata.
Q. Kelloggii ..... P. corylea.
Q. serrata ..... M. alni.
Ranunculus *nemorosus, *recurvatus ..... E. polygoni.
*Rhabdosciadium Aucheri ..... E. polygoni.
Rhus succedanea, vernicifera ..... U. verniciferae.
Ribes Magellanicum ..... P. corylea.
Robinia Pseudacacia ..... E. polygoni.
Rosa *Eglanteria, *fragrans ..... S. pannosa.
Rubus *Idaeus, villosus ..... S. humuli.
*Ruta Buxbaumii ..... ? E. taurica (see p. 198).
Salix gracilistyla, multinervis, stipularis ..... U. salicis.
*Salvia glutinosa ..... E. cichoracearum.
*S. officinalis ..... E. galeopsidis.
Saussurea sp. ..... E. taurica.
Saxifraga punctata ..... S. humuli fuliginea.
Scabiosa stellata, succisa ..... E. polygoni.
Scutellaria *lateriflora, *pilosa ..... E. galeopsidis.
Sedum Telephium purpureum ..... E. polygoni.
Senecio cineraria ..... S. humuli fuliginea.
S. *erucifolius, Fuchsii ..... E. cichoracearum.
S. Muehlenbergii ..... S humuli fuliginea.
S. *silvaticus, *viscosus ..... E. cichoracearum.
Sisymbrium officinale ..... E. polygoni.
*Sium latifolium ..... E. polygoni.
*Solidago latifolia ..... E. cichoracearum.
*Sonchus oleraceus ..... E. polygoni.
Styrax Japonicum ..... M. alni
Symphytum tauricum ..... E. cichoracearum.
Syringa vulgaris ..... M. alni lonicerae.
" " ..... P. corylea.
Tagetes minuta ..... E. galeopsidis.
Teucrium Scorodonia ..... E. galeopsidis.
*Thesium alpinum ..... E. polygoni.
*Tilia sp. ..... P. corylea.
T. Miqueliana ..... U. Miyabei.
*Torilis Anthriscus ..... E. polygoni.
*Tragopogon pratensis ..... S. humuli.
Trifolium agrarium, *spadiceum ..... E. polygoni.
Ulmus parvifolia ..... U. clandestina.
Urtica urens ..... E. polygoni.
*Vaccinium Vitis-Idaea ..... P. oxyacanthae.
*Valeriana officinalis ..... E. polygoni.
*Valerianella sp. ..... E. polygoni.
*V. olitoria ..... E. polygoni.
Verbascum Lychnitis ..... E. taurica.
" " ..... E. cichoracearum.
Veronica *Chamaedrys, *orientalis, *spuria ..... S. "Castagnei."

V. Virginica var. Sibirica.....S. humuli.
Vicia *tenuifolia, venosa capitata.....E. polygoni.
*Vitis cordifolia.....U. necator.
*Willughbya scandens.....E. cichoracearum.
*Zinnia elegans.....E. cichoracearum.

SPECIES INDEX

(*Synonyms in italics.*)

Alphitomorpha rosarum Wallr., 303
A. penicillata rosarum Wallr., 303
Botrytis euphorbiae Cast., 95
Calocladia bicornis rosae (Wallr.) Hazsl., 303
ERYSIPHE, 2, 5, 7, 12, 21
E. acanthophylli Speschn., 198, 199
E. aggregata (Peck) Farl., 200
E. album Fr., 302
E. alni DC., 208
E. andicola Speg. mss., 191
E. Bertoloni Roumeg., 303
E. cichoracearum DC., 2, 3, 5, 13, 14, 17, 18, 19, 91, 185–187, 191–195, 197, 199
E. communis, 3, 14, 17, 18, 100, 108, 185, 186, 190, 194
E. coryli Hedw., 200
E. deserticola Speg., 2, 303, 304
E. euphorbiae Peck, 199, 304
E. euphorbiae Speschn., 198
E. Fricki Neger, 2, 181, 182
E. fungicola Schulz., 200
E. fuscata Berk. & Curt., 90
E. galeopsidis DC., 2, 3, 5, 185, 187, 192, 193–195, 197
E. graminis DC., 4, 5, 20, 195, 196
E. lamprocarpa Lév., 14, 192, 194
E. lamprocarpa polemoniacearum Serb., 3, 305
E. lathyri Mér., 302
E. Martii Lév., 17, 109, 182, 185, 186, 190, 191, 193
E. pisi DC., 181–183, 186
E. pisi desmodii P. Henn., 2, 181, 182, 186
E. polygoni DC., 2, 5, 12, 17, 91, 104, 181, 182–189, 192, 197, 209
E. polygoni sepulta (Ell. & Everh.) Salm., 190
E. saxifragae-Sibericae Mér., 302
E. stellata and vars. *coryli* and *alni* L. Marchand, 208
E. taurica Lév., 5, 90, 91, 185, 192, 195, 197–199
E. tiliae Mér., 302
E. tortilis (Wallr.) Fr., 12, 20, 184, 197
E. trina Harkn., 84
E. umbelliferarum de Bary, 185, 186, 187
E. umbelliferarum platensis Speg. mss., 192
Erysiphella Carestiana Sacc., 206
Euuncinula, 6, 7
MICROSPHAERA 5, 6, 7, 12, 21
M. alni (Wallr.) Salm., 2, 5, 17, 18, 105
M. alni divaricata (Wallr.) Salm., 108
M. alni extensa (Cooke & Peck) Salm., 108
M. alni lonicerae (DC.) Salm., 14, 17, 18, 107
M. alni ludens Salm., 108, 209
M. astragali (DC.) Trev., 7, 12, 105, 184
M. Bäumleri P. Magn., 12, 104, 109, 184, 185
M. berberidis (DC.) Lév., 5, 103, 107
M. Caraganae P. Magn., 104, 181
M. diffusa Cooke & Peck, 109, 304
M. Ehrenbergii Lév., 14, 17, 107
M. euonymi (DC.) Sacc., 5, 12, 104
M. euonymi borealis Serb., 3, 104
M. euphorbiae (Peck) Berk. & Curt., 5, 109, 304
M. grossulariae (Wallr.) Lév., 5, 108
M. Japonica P. Henn., 1, 105, 107
M. Mougeotii Lév., 109
M. Myoschili Neger, 2, 105
M. sambucicola P. Henn., 1, 108
M. syringae (Schwein.) P. Magn., 105
Microsphaeroidea, 6, 7
Oidium, 2, 3, 14, 15, 16, 17, 19, 20, 88, 98
O. bulbigerum (Bonord.) Sacc. & Vogl., 195
O. ceratoniae Comes., 188, 189
O chrysanthemi Rabenh., 193
O. euphorbiae Thüm., mss., 95
O. fragariae Harz., 87, 88
O. haplophylli P. Magn., 198
O. leucoconium Desm., 91
O. mespilinum Thüm., 196
O. monilioides Link., 196
O. monosporum Pass., 181, 187
O. Passerini Bertol. f., 303
O. rubellum (Bon.) Sacc. & Vogl., 195
O. tabaci Thüm., 13
O. tritici Lib., 196
Oospora epilobii (Corda) Sacc. & Vogl., 87
PHYLLACTINIA, 4, 5, 6, 7, 10, 14, 15
P. antarctica Speg., 2
P. Candolli Lév., 208
P. clavariaeformis Neger, 2, 200–204, 209

P. corylea (Pers.) Karst., 2, 18, 200–208, 210
P. fungicola (Schulz.) Hazsl., 200
? *P. fungicola* (Schulz.) Sacc., 200
P. suffulta (Rebent.) Sacc., 15
P. suffulta moricola P. Henn., 1, 200, 203
PODOSPHAERA, 6, 7, 86
P. biuncinata Cooke & Peck, 85
P. clandestina ramulicola Thüm., 83
P. leucotricha (Ell. & Everh.) Salm., 86, 91, 92
P. myrtillina Kze. & Schmidt, 84
P. oxyacanthae (DC.) de Bary, 21, 83
P. oxyacanthae *tridactyla* (Wallr.) Salm., 84, 85
SPHAEROTHECA, 5, 7, 21
S. Castagnei Lév., 11, 18, 89, 90, 91, 184
S. euphorbiae (Cast.) Salm., 94, 95, 304
S. fuscata (Berk. & Curt.) Serb., 89, 90
S. humuli (DC.) Burr. 11, 13, 16, 17, 20, 84, 87, 91, 184
S. humuli fuliginea (Schlecht.) Salm., 11, 87, 89
S. Kusanoi P. Henn. & Shirai, 1, 3, 95, 103
S. lanestris Harkn., 3, 95, 103
S. mali Burr., 86
S. microcarpa Hazsl., 89
S. mors-uvae (Schwein.) Berk. & Curt., 3, 93, 184
S. pannosa (Wallr.) Lév., 16, 18, 85, 86, 91
S. phtheirospermi P. Henn. & Shirai, 1, 89, 90
Torula bulbigera Bonord., 196
T. epilobii Corda, 87, 88
T. rubella Bonord., 195
T. tritici (Lib.) Corda, 196
Trichocladia, 7, 12
T. astragali (DC.) Neger, 105
T. tortilis (Wallr.) Neger, 197
UNCINULA, 6, 7, 21
U. aceris (DC.) Sacc., 6, 9, 97, 98
U. circinata Cooke & Peck, 6, 7, 8, 10
U. clandestina (Biv. Bern.) Schroet., 6, 99
U. clandestina forma Japonica P. Henn., 1, 99
U. Clintonii Peck, 9, 100
U. columbiana Selby, 10, 97
U. flexuosa Peck, 6
U. geniculata Gerard, 11
U. Kusanoi H. & P. Syd., 2, 100
U. macrospora Peck, 6, 9, 100
U. Miyabei Salm., 97
U. necator (Schwein.) Burr., 6, 18, 20, 99
U. polychaeta (Berk. & Curt.) Ellis, 6, 10, 101, 199, 208
U. prunastri (DC.) Sacc., 6, 9, 98
U. salicis (DC.) Wint., 4, 6, 9, 10, 11, 96
U. salicis epiobii Vestergr., 10, 97
U. septata Salm., 3, 102
U. Shiraiana P. Henn., 1, 101
U. Tulasnei Fckl. 98
U. verniciferae P. Henn., 1, 2, 101
U. Wallrothii Lév., 11, 98
U. Zelkowae P. Henn., 1, 100, 101

Index to recent Literature relating to American Botany

Allison, A. A curious Root Parasite. Plant World, **5**: 14, 15. Ja. 1902.

Bates, J. M. A fall-flowering Violet. Plant World, **5**: 13. Ja. 1902.

Bishop, I. T. Variation in *Trillium* Flowers. Plant World, **5**: 11. Ja. 1902.

Boodle, L. A. On Lignification in the Phloem of *Helianthus annuus*. Ann. Bot. **16**: 180–183. Mr. 1902.

Brand, A. Symplocaceae. Das Pflanzenreich, **4**[242]: 1–100. 5 N. 1901.

Conard, H. S. Note on Embryo of *Nymphaea*. Science, II. **15**: 316. 21 F. 1902.

Copeland, E. B. The Conjugation of *Spirogyra crassa* Kg. Bull. Torrey Club, **29**: 161–163. 24 Mr. 1902. [Illust.]

Coville, F. V. *Ribes aurum* and *Ribes lentum*. Proc. Biol. Soc. Wash. **15**: 23–29. 5 Mr. 1902.

Field, H. H. The Botanical Section of the Concilium Bibliographicum in Zürich. Science, III, **15**: 357. 28 F. 1902.

Ford, S. O. The Anatomy of *Ceratopteris thalictroides* (L.). Ann. Bot. **16**: 95–121. *pl. 6 + f. 1–8*. Mr. 1902.

Gager, C. S. The Development of the Pollinium and Sperm-Cells in *Asclepias Cornuti* Decaisne. Ann. Bot. **16**: 123–148. *pl. 7*. Mr. 1902.

Giesenhagen, K. *Taphrina*, *Exoascus* und *Magnusiella*. Bot. Zeitung, **59**: 115–142. *pl. 5*. 15 Jl. 1901.

Goebel, K. Morphologische und biologische Bemerkungen. II. Ueber Homologien in der Entwicklung männlicher und weiblicher Geschlechtsorgane. Flora, **90**: 279–305. *f. 1–9*. 30 Ja. 1902.

Golenkin, M. Die Mycorrhiza-ähnlichen Bildungen der Marchantiaceen. Flora, **90**: 209–220. *pl. 11 + f. 1–15*. 30 Ja. 1902.

Greene, E. L. Some new Northwestern Compositae. Ottawa Nat. **15**: 278–284. Mr. 1902.

Greene, E. L. Two new Erigerons. Bull. So. Cal. Acad. Sci. **1**: 39. 1 Ap. 1892.

Griffiths, D. A novel Seed Planter. Bull. Torrey Club, **29**: 164–169. 24 Mr. 1902.

Harshberger, J. W. A botanical Ascent of Mount Ktaadn, Me. Plant World, **5**: 23–28. *pl. 5, 6.* F. 1902.

Hay, G. U. Notes of a wild Garden. Bull. Nat. Hist. Soc. N. B. **4**: 108–113. 1899.

Hay, G. U. Preliminary List of New Brunswick Fungi. Bull. Nat. Hist. Soc. N. B. **4**: 341–349. 1901.

Holzner. Die äussere Samenhaut der deutschen Drosera-Arten. Flora, **90**: 342, 343. 30 Ja 1902.

Holzner. Die Caruncula der Samen von *Polygala*. Flora, **90**: 343, 344. 30 Ja. 1902.

Karsten, G. Ueber die Entwickelung der weiblichen Blüthen bei einigen Juglandaceen. Flora, **90**: 316–333. *pl. 12. f. 1–21.* 30 Ja. 1902.

Knowlton, F. H. A Primrose at Home. Plant World, **5**: 32, 33. *pl. 6.* F. 1902.

Kupfer, E. M. Studies on *Urnula* and *Geopyxis*. Bull. Torrey Club, **29**: 137–144. *pl. 8.* 24 Mr. 1902.
Establishes *Chorioactis* gen. nov. on *Urnula Geaster* Peck.

Lang, W. H. On the Prothalli of *Ophioglossum pendulum* and *Helminthostachys Zeylanica*. Ann. Bot. **16**: 23–56. *pl. 1–3.* Mr. 1902.

Longyear, B. O. A Sclerotium Disease of the Huckleberry. Rep. Mich. Acad. Sci. **3**: 61, 62. *pl. 2.* 1902.

Longyear, B. O. Notes on Michigan saprophytic Fungi. Rep. Mich. Acad. Sci. **3**: 55–57. 1902.

Longyear, B. O. New Species of Michigan Fungi. Rep. Mich. Acad. Sci. **3**: 57–60. *pl. 1.* 1902.
New species in *Lepiota*, *Lactarius* (2), *Annularia*, and *Leptonia*.

Lovell, J. H. The Colors of northern polypetalous Flowers. Am. Nat. **36**: 203–240. Mr. 1902.

Macoun, J. M. Contributions to Canadian Botany. Ottawa Nat. **15**: 267–275. Mr. 1902.

Malme, G. O. A. Die Compositen der ersten Regnell'schen Expedition. Kongl. Sv. Vet.-Akad. Handl. **32**[5]: 1–90. *pl. 1–7.* 1899.
New species in *Vernonia* (3), *Alomia*, *Stevia*, *Eupatorium* (2), *Aster*, *Baccharis*, *Alpilia* (2), *Isostigma*, *Porophyllum*, *Pectis*, *Erechthites*, *Moguinia* and *Chuguiraguа*.

Massee, G. & Salmon, E. S. Researches on coprophilous Fungi, II. Ann. Bot. **16**: 57–93. *pl. 4, 5.* Mr. 1902.
Includes new species in various families.

Means, T. H. On the Reason for the Retention of Salt near the Surface of Soils. Science, II. **15**: 33. 3 Ja. 1900.

Meehan, T. *Gentiana angustifolia.* Meehan's Monthly, **12**: 53, 54. *pl. 4.* Ap. 1902.

Miller, G., Jr. The technical Names of two Dogbanes from the District of Columbia. Proc. Biol. Soc. Wash. **15**: 35, 36. 5 Mr. 1902.

Munson, W. M. The horticultural Status of the Genus *Vaccinium.* Bull. Maine Agric. Exp. Sta. **76**: 113–160. Au. 1901. [Illust.]

Neger, F. W. Beiträge zur Biologie der Erysipheen (2. Mittheilung). Flora, **90**: 221–272. *f. 1–27.* 30 Ja. 1902.

O'Brien, A. A. Notes on the Comparative Resistance to high Temperatures of the Spores and Mycelium of certain Fungi. Bull. Torrey Club, **29**: 170–172. 24 Mr. 1902.

Osterhout, G. E. *Hesperaster nudus* (Pursh) Cockerell and its Allies. Bull. Torrey Club, **29**: 173, 174. 24 Mr. 1902.

Hesperaster stictus, new species.

Pax, F. Aceraceae. Das Pflanzenreich, 4^{163}: 1–89. *pl. 1, 2.* 7 Ja. 1902.

Perkins, J. & Gilg, E. Monimiaceae. Das Pflanzenreich, 4^{101}: 1–122. 21 Je. 1901.

Pollard, C. L. Plant Agencies in the Formation of the Florida Keys. Plant World, **5**: 8–10. *pl. 4.* Ja. 1902.

Rendle, A. B. Naiadaceae. Das Pflanzenreich, 4^{12}: 1–21. 17 D. 1901.

Ruhland, W. Zur Kenntniss der intracellularen Karyogamie bei den Basidiomyceten. Bot. Zeitung, **59**: 187–206. *pl. 7.* 15 O. 1901.

Rydberg, P. A. Studies on the Rocky Mountain Flora.—VII. Bull. Torrey Club, **29**: 145–160. 24 Mr. 1902.

New species in *Aquilegia* (4), *Delphinium* (5), *Aconitum* (4), *Anemone* (3), *Clematis* (2), *Atragene* (3), *Ranunculus* (4), *Papaver*, *Argemone*, and *Bicuculla*.

Safford, W. E. The Name "Dog's-Tooth-Violet." Plant World, **5**: 11, 12. Ja. 1902.

Saunders, C. F. Botanizing in Winter. Plant World, **5**: 30–32. F. 1902.

Schrenk, H. von. The Decay of Timber and Methods of preventing it. Bull. U. S. Dept. Agric. (Pl. Ind.) **14**: 1–96. *pl. 1–18* + *f. 1–25.* 25 Mr. 1902.

Simpson, C. T. A Visit to the Royal Palm Hammock of Florida. Plant World, **5**: 4–7. Ja. 1902.

Solms-Laubach, H. Graf zu. Hydnoraceae. Das Pflanzenreich, **4**[76]: 1–9. 5 N. 1901.

Solms-Laubach, H. Graf zu. Rafflesiaceae. Das Pflanzenreich, **4**[75]: 1–19. 5 N. 1901.

Spegazzini, C. Nova Addenda ad floram Patagonicam. An. Soc. Cient. Arg. **53**: 13–34. 1902.
New species in *Senecio* (6), *Brachycladus*, *Leuceria*, *Nassauvia*.

Stolz, F. Zur Biologie der Laubmoose. Flora, **90**: 305–315. 30 Ja. 1902.

Tansley, A. G. and Lulham, R. B. On a new Type of Fern-stele, and its probable phylogenetic Relations. Ann. Bot. **16**: 157–164. *f. 9–18.* Mr. 1902.

Tischler, G. Ueber die Bildung von "verjüngten" Stämmchen bei alternden Weiden. Flora, **90**: 273–278. *f. 1–4.* 30 Ja. 1902.

Trelease, W. The Missouri Botanical Garden. Plant World, **5**: 1–4, *pl. 1–3.* Ja. 1902.

Underwood, L. M. American Ferns—III. Our Genera of Aspidieae. Bull. Torrey Club, **29**: 121–136. 24 Mr. 1902.

Vines, S. H. Tryptophane in Proteolysis. Ann. Bot. **16**: 1–22. Mr. 1902.

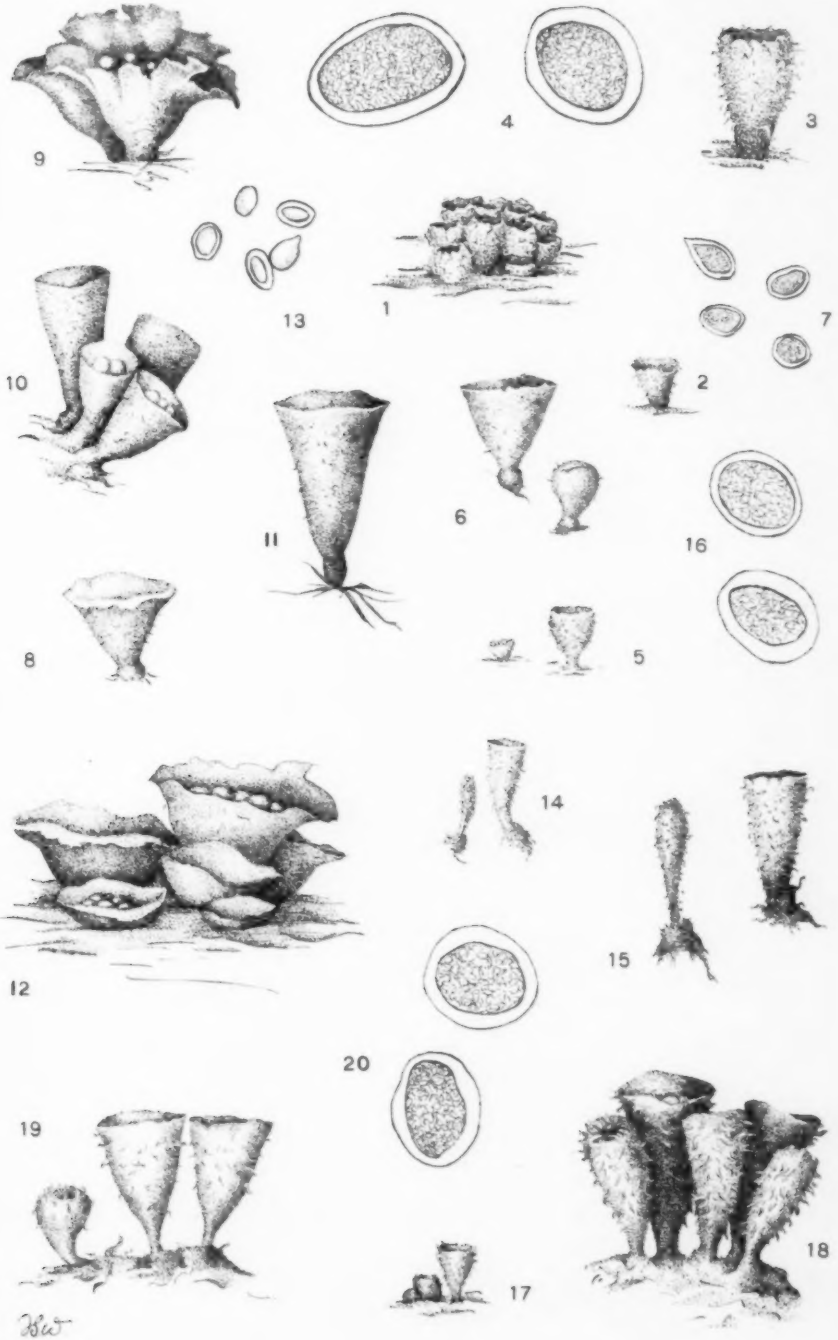
Waters, C. E. Another Trip to Glen Burnie, Maryland. Plant World, **5**: 28–30. F. 1902.

Wildeman, E. de. *Mimosa Uruguensis* H. & A. Ic. select. Hort. Thenensis, **3**: 25. *pl. 87.* Ja. 1902.

Wildeman, E. de. *Limnanthes Douglasii* R. Br. Ic. select. Hort. Thenensis, **3**: 21. *pl. 86.* Ja. 1902.

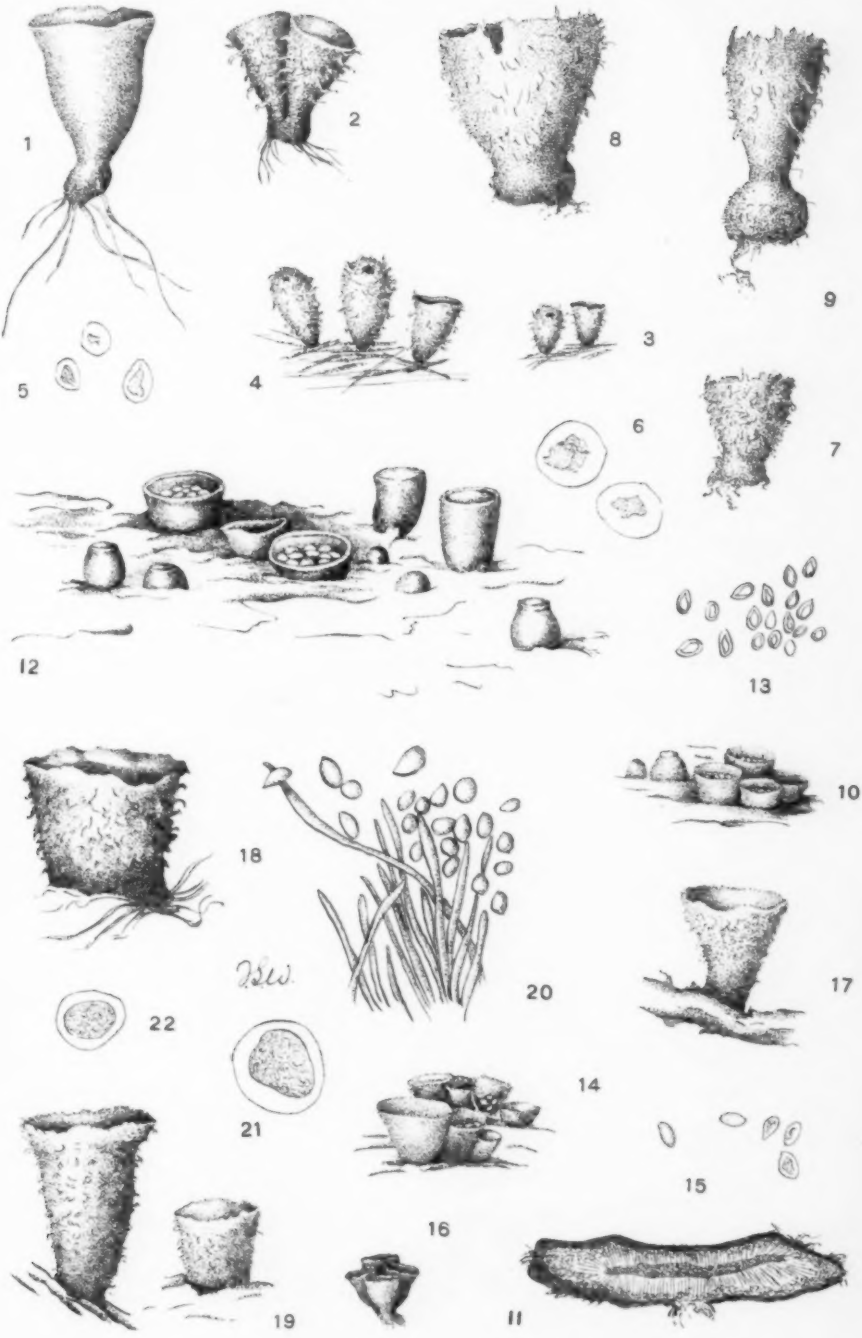
CYATHUS.

HELIOTYPE CO., BOSTON.



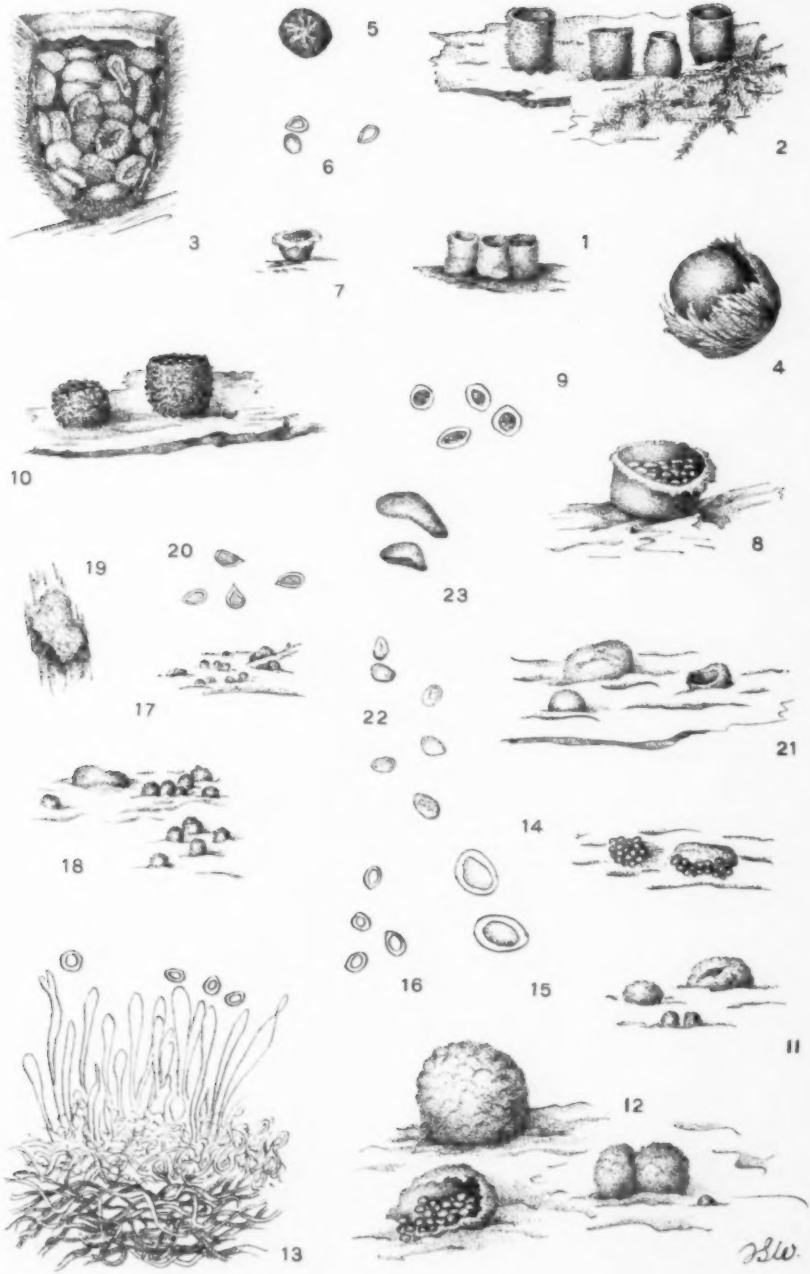
CYATHUS.

HELIOTYPE CO., BOSTON.



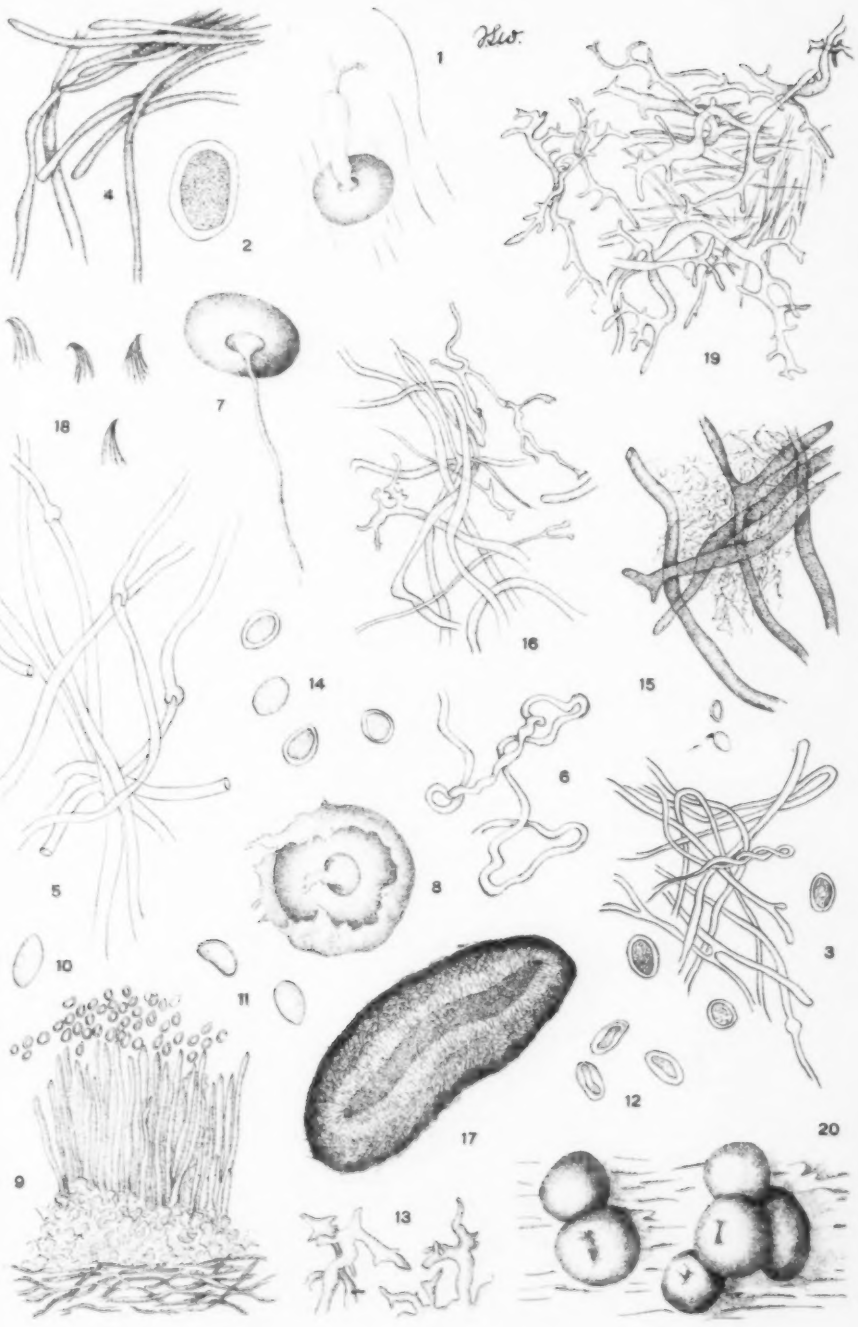
CYATHUS, CRUCIBULUM, NIDULA.

HELIOTYPE CO., BOSTON.



NIDULA, GRANULARIA.

HELIOTYPE CO., BOSTON.



NIDULARIACEAE.

HELIOTYPE CO., BOSTON.